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August 14, 2009

Mr. James M. DiLorenzo
Remedial Project Manager
United States Environmental Protection Agency
Office of Site Remediation and Restoration
1 Congress Street, Suite 1100 (HBO)
Boston, Massachusetts, 02114-2023

Dear Mr. DiLorenzo,

Subject: August 14, 2009 Final RI/FS Work Plan Submittal
Olin Chemical Superfund Site, Wilmington Massachusetts

Enclosed please find 7 hard copies and 10 electronic copies (Adobe™ PDF format) of the document titled *Final Remedial Investigation/Feasibility Study Work Plan, Olin Chemical Superfund Site, Wilmington, Massachusetts*, dated *August 14, 2009*. This document is being submitted in accordance with requirements specified in Sections 1.III.A, D and E, and Section 2.II.F of the Final Statement of Work (SOW) for the Olin Chemical Superfund Site; and the EPA letter titled *Conditional Approval, Draft Final Remedial Investigation / Feasibility Study Work Plan, Olin Chemical Superfund Site, Wilmington, Mass*, dated July 16, 2009.

The SOW is incorporated by reference into the Administrative Settle Agreement and Order On Consent for Remedial Investigation/Feasibility Study for the Olin Chemical Superfund Site, Wilmington, Massachusetts (USEPA CERCLA Docket No. 01-2007-0102).

The RI/FS Work Plan includes the following volumes

Volume I – RI/FS Work Plan Project Overview
Volume II – Site Management Plan and Community Relations Support Plan
Volume III – Sampling and Analysis Plan (two separate documents as separate volumes).
    Volume III-A – Field Sampling Plan (FSP)
    Volume III-B – Quality Assurance Project Plan (QAPP)
Volume IV – Health and Safety Plan (HASP)

All four volumes make up the RI/FS Work Plan. Volumes II through IV are the components of the Project Operations Plan (POP).

The *Response to the USEPA Conditional Approval and Comments, DRAFT FINAL Remedial Investigation/Feasibility Study Work Plan, Olin Chemical Superfund Site, Wilmington, Massachusetts* and the first addendum to the *Final Remedial Investigation/Feasibility Study Work Plan, Olin Chemical Superfund Site, Wilmington, Massachusetts,* dated *August 14, 2009, Addendum I – North Pond Investigation* have both been enclosed in the binder of Volume I of the Final Work Plan.

One hard copy and an electronic copy of this deliverable have also been sent to Joseph Coyne with the Massachusetts Department of Environmental Protection.

If you have any questions concerning this deliverable, please do not hesitate to contact Steve Morrow at 423-336-4511.

Sincerely,

Steve Morrow

Cc File
P. Thompson, MACTEC (1)
Joseph Coyne, MADEP

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Mr. James M. DiLorenzo
Remedial Project Manager
United State Environmental Protection Agency
Office of Site Remediation and Restoration
One Congress Street, Suite 1100 (HBO)
Boston, Massachusetts 02114-2023

Subject: Response to USEPA Conditional Approval and Comments
DRAFT FINAL Remedial Investigation/Feasibility Study Work Plan
Olin Chemical Superfund Site, Wilmington, Massachusetts

Dear Mr. DiLorenzo:

Enclosed please find Olin's response to Approval Conditions and comments received from USEPA on July 16, 2009 in the *Conditional Approval DRAFT FINAL Remedial Investigation/Feasibility Study Work Plan Olin Chemical Superfund Site, Wilmington, Massachusetts*. The letter first identifies how each of the five Conditions of Approval will be met and then addresses each of the additional comments provided with respect to the Draft Final Work Plan.

A copy of this Response to Comments letter has been included with each hard copy and electronic copy of the *Final Remedial Investigation/Feasibility Study Work Plan, Olin Chemical Superfund Site, Wilmington, Massachusetts* dated August 14, 2009.

If you have any questions concerning this deliverable, please do not hesitate to contact me at 423-336-4511.

Sincerely,

Steve Morrow
Principal Environmental Specialist

CONDITIONS

1. Financial Assurance: Pursuant to Paragraphs 94 to 98 of the AOC, within 30 days from the date of this approval letter, Olin shall submit a cost estimate for completion of the full activities described in the Final RI/FS Work Plan. Based on the amount of this cost estimate, Olin (and the other Respondents) shall establish and maintain financial security for the benefit of EPA using one or more of the forms outlined in the AOC.

RESPONSE

Olin will submit cost estimate and financial assurance under a separate cover.

2. Well Construction Details: The Draft RI/FS Work Plan states that Olin is currently reviewing several well construction options and will provide an addendum with these details prior to field mobilization. Olin shall submit an addendum to the RI/FS Work Plan that provides well installation and construction details, as well as the criteria to be used to field-identify exact well locations, and well screen intervals, at least two weeks prior to field mobilization for the installation of new monitoring wells.

RESPONSE

Olin will provide the addendum as requested.

3. Slurry Wall Testing: Section 6.5 of the Draft RI/FS Work Plan discusses the implementation of Hydraulic Pulse Interference Testing as a non-destructive method for assessing the structural integrity of the slurry wall. Olin shall submit an addendum to the RI/FS Work Plan that provides the necessary details regarding the implementation and evaluation of this test. This addendum should also include a proposal to effectively monitor the slurry wall/bedrock interface (i.e., additional wells, pump tests, etc.) This addendum should be submitted within 60 days from the date of this approval letter and no later than 30 days prior to field mobilization for this test.

RESPONSE

Olin will provide the addendum as requested.

4. North Pond Area: Despite continuous requests by EPA to adequately characterize the North Pond area, the draft Work Plan does not propose any site characterization or analysis. Ariel photographs confirm that North Pond was hydraulically connected to the East Ditch, south of the confluence with the South Ditch, as an upon channel, and remains connected through a culvert. The one sediment sample collected to date from the existing North Pond basin confirms the presence of several site-related compounds. The Final Work Plan must include a reasonable proposal to characterize the current and former extent of the North Pond area (see OU2 comment below), and

a proposal to incorporate the results into the BHHRA and ERA for OU2.

RESPONSE

The proposal for investigation of the North Pond will be included in an Addendum to the Final Work Plan (as agreed upon with USEPA). That Final Work Plan Addendum for the North Pond Investigation will include a detailed summary of the results of the records searches for the pond as well as the previous investigation activities performed by Olin and others and the proposed RI investigation activities.

While the addendum will be developed and provided for further evaluation of the North Pond, several visual inspections by Olin of the area between the Site and the rail line have not identified the western end of a culvert nor any other pipe or conveyance that potentially was located beneath the rail line. Additionally, these inspections have identified no visual evidence of any existing connection between the East Ditch (between the Site and the rail line) and the North Pond. Extensive records searches, a surface water and sediment sampling event conducted by Roy F. Weston for USEPA, and three separate field investigations conducted by Olin have provided useful information concerning the history of the North Pond and have lead to the conclusion that any Site impacts (if any) on historical sediments of the North Pond would be very difficult, if not impossible to characterize. This is because, based on the Superseding Order of Conditions issued by the Massachusetts Department of Environmental Quality in 1984, it appears that the majority of the sediments from the pond were excavated in the 1980s, the pond was almost completely re-worked during the construction of Presidential Way and the development of additional commercial/industrial buildings on fill placed into the pond (approximately 73% of the pond has been filled), and physical modifications undertaken to the pond to enhance its flood storage capacity. Even if buried historical sediments had been impacted by the Site (surface water discharges occurred from 1953 to 1972) and they were still present, the buried sediments would not represent a current or future exposure pathway for either human or ecological receptors. Sediment exposures for these receptors are evaluated by characterizing surficial sediments (top six inches) – any buried historical sediments that might still be present would not be included in those surficial sediments. In other words, any remaining buried historical sediments would not pose any substantial human health or ecological risks.

5. Right to Request Additional Samples/Analysis: Although the current version of the

RI/FS Work Plan provides a significant increase in the overall number of samples and compounds to be analyzed across all media, there are several areas where the proposed approach may not provide sufficient data to characterize the nature and extent of contamination, or quantify the potential human health or ecological exposures. Examples include but are not limited to the approach for characterizing soils deeper than 10 feet bgs; limited analysis for PCBs and pesticides/herbicides; the inability to analyze for several compounds of historic Site use due to a lack of analytical methods; no proposal to characterize subsurface soil within the containment area; no proposal to characterize soil within the Calcium Sulfate Landfill, no proposal to install a bedrock well within the central area of the MMB aquifer; and the collection of limited data from surface water bodies located south of Site property. Although EPA agrees and accepts these limitations based on the current understanding of this Site, EPA reserves the right to request the collection of additional samples and/or analysis based on the results of the approved RI sampling effort.

RESPONSE:

Comment noted.

COMMENTS

Volume I

COMMENT

1. General: There are numerous statements made within the body of this work plan and in various summary tables, and in particular in Volume **I,** which EPA believes are either premature or unsupported by the current data set. Examples of such statements include: The DAPL pools *are not currently moving* along the bedrock surface in response to gravity; The slurry and temporary cap was constructed to contain residual on-Property DAPL and *overlying contaminated groundwater,* and Currently the DAPL material remains in *isolated* bedrock depressions. Rather than call out and dispute the basis for each and every example, EPA requests that Olin acknowledge in response to this comment that such findings as stated within the work plan will be re-evaluated based on data collected during the RI field work.

RESPONSE:

The current Conceptual Site Model (CSM) is based on the currently available information and will be updated based on information obtained during the RI field work.

COMMENT

2. General: The current terms of the AOC (Appendix A SOW) require that electronic access to data be extended only to EPA and EPA's consultant. As a result, Olin has established an FTP link which allows EPA to download digital data. EPA continues to receive concerns from stakeholders over the lack of external data access. Although all existing data has been provided in Adobe format, the effort and

expertise necessary to effectively access and review such an expansive data-set is beyond most party's capabilities. While Olin has chosen to restrict non-EPA access to data, it has been our experience that allowing for broader access to data results in fewer questions during the RI/FS process and supports effective consensus-building for the Proposed Plan. For example, at the Nuclear Metals Superfund Site in Concord, Massachusetts (see www.nmisite.orq), the PRPs have developed an on-line tool that allows broad community and stakeholder access to data-validation level results. The Nuclear Metals website includes an interactive web-based Geographic Information System (GIS) utility that will graphically display sample locations and results on a map of the site, allowing easy interpretation of the data. Another example is the ARCGIS database. Such tools would aid all interested parties in evaluating the data and should greatly improve consensus-building for the pending Proposed Plan(s) and Record(s) of Decision. EPA strongly recommends that Olin give serious consideration to developing such tools, or at a minimum, expanding access to the existing digital data base. If upon consideration, Olin remains concerned about providing broad access to the overall data set, then EPA would urge Olin to consider providing such access to at least the RI data set.

RESPONSE:

Olin has taken this comment under consideration.

COMMENT

3. General: Numerous figures and tables in the draft Work Plan are under-scaled for the intended information. Although EPA is not requesting that the scale of the Final Work Plan figures and tables be modified, this is a significant issue that should be addressed in any work plan addendums and the RI Reports. EPA respectfully requests that figures and tables in the work plan addendums and RI reports be scaled appropriately such that oversized drawings and tables (i.e., 11" x 17" or plan-sized) are provided as necessary to effectively convey the intended information. Also, RI figures should include identification of major features appropriate to support the intended information (e.g., Fig. 4.3-1 should identify surface water features and wetland areas, Fig. 4.5-2 should identify all relevant street names and buildings, and so on).

RESPONSE:

Comment noted. Figures will be scaled appropriately in future addenda and RI-related reports.

COMMENT

4. P. 7 of 50, Response to EPA Comment No. 2d: Olin's response states that soil samples collected from deeper than 10 feet bgs will be analyzed based on results of 1- 10 foot samples, with a minimum of six deep soil samples to be analyzed from areas with the greatest potential for impacts regardless of 0-10 foot soil results. This information is repeated in Volume III-A, Section 4.2.3. However, the details associated with this deep soil sampling program need to be provided in Section 8.1

of Volume IIIA. Please incorporate. Note also that EPA is concerned that holding times may be exceeded for some contaminants in the deeper soils while awaiting results from the 1- 10 foot samples, and this concern should be addressed in the FSP.

RESPONSE:

Section 8.1.2 of the Final Volume III-A Field Sampling Plan has been revised to include details regarding the deep soil sampling program. In the following text, text that has been revised or added since the previous submittal is identified with italics. The text has been revised to state:

"*At locations with multiple soil sample depths, the top sample will be collected from 0 -1 foot bgs and then a 2-foot horizon within the 1 – 10 foot interval will be selected for sampling based on PID readings, visual observation, and/or olfactory observation. If field observations do not lead to a clear choice of horizon, the horizon will be chosen at random and documented in the field books with preference given to samples immediately above the water table.*

If VOC or VPH samples are scheduled for analysis from the 1-10 foot interval, they will be collected immediately following the 0-1 foot interval in accordance with SOP No. S-13 "Field Preservation of VOA and VPH Soil Samples", after the interval is screened with a PID. The remaining sample collection will continue in the same manner as described for the 0-1 foot interval. The appropriate sample container will be selected and the sample placed in the sample in the container, capped and labeled, and placed into a cooler to initiate sample storage and preservation procedures.

To the extent possible, the decision to conduct laboratory analysis of the soil samples collected from greater than 10 feet bgs will depend on the laboratory results for the soil samples collected from the 1 – 10 foot interval. The analytical results for a soil sample collected from within the 1 – 10 feet interval will be compared to the USEPA RSLs for industrial land use and the Groundwater Protection Soil Screening Levels (risk-based) published in the RSL Table (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables /index.htm). For any analyte group (such as SVOCs), if all detected chemicals in that analyte group have associated RSL and SSLs and all reported concentrations are below the corresponding RSLs and SSLs, then the sample collected from greater than 10 feet at that location will not be analyzed for that analyte

group. If one or more chemicals in an analyte group has a reported concentration that is above either or both the RSL and SSL (or does not have RSLs), then the sample collected from greater than 10 feet at that location will be analyzed for that analyte group. A minimum of six soil samples collected from depths greater than 10 feet bgs in the areas of the former unlined impoundments in the former production area will be analyzed for the standard comprehensive analyte list plus the "additional Site-specific analyte list". Those samples will be collected and analyzed to assess the potential presence of DAPL material."

Text added to Section 9.2 discusses the procedures that will be implemented to insure that hold times are met for all laboratory analyses.

COMMENT

5. P. 9 of 50. Response to EPA Comment No. 7d: Olin's response states that benzonitrile, 2-ethyl hexoic acid, trimethylamine, hexamethyene tetramine, and dinonyl phenol will not be analyzed during the RI because "analytical methods are not available". EPA concurs that standard analytical methods do not currently exist for these compounds. However labs can be instructed to report "tentatively identified compounds (TICs)" which could identify these compounds if present at relatively elevated concentrations. Olin should instruct their labs to include these compounds as TICs and to continue to include these compounds in the uncertainties section of the appropriate risk assessments.

RESPONSE:

Olin will instruct the laboratory to report TICs. The majority of these compounds should be identifiable as TICs if present. As discussed previously with USEPA there is no analytical method available for dinonyl phenol as this compound has numerous potential isomers. TICs will be identified and reported by the laboratory based on available analytical library searches. Olin will continue to include these compounds in the uncertainties section of the appropriate risk assessments.

COMMENT

6. P. 9 of 50, Response to EPA Comment No. 8b: In this comment, EPA noted concern regarding the unusually high background concentration for ammonia. Olin's response is, "Background data sets for surface water and sediment will be recollected." However, according to the proposal for background data as contained in the bullets on p. 3-5 of Volume III-A, it appears that Olin plans to use the existing background data from locations BS021 REF and BS012REF in the RI? Historical background soil location BS021REF and sediment location BS012REF cannot be

included as background locations in the RI.

RESPONSE:

The text discussion of background conditions that appeared on page 3-5 has been revised as shown below. The soil, surface water, and sediment background conditions will be characterized by resampling and analysis of previous background sample locations (except re-sampling of soils from the GW-83D and GW-85D well installations which is not feasible). The revised or added text is identified below with italics.

"The RI will characterize background conditions by *re-sampling all* historical background *locations including soil,* surface water, and sediment locations as discussed below. Much of the background conditions information has been previously presented in the 1997 Supplemental Phase II Report (Smith, 1997). Attachment 3 of Appendix S of that report is the Characterization of Background Conditions. The following text *identifies the background locations where samples will be collected and submitted for laboratory analysis for the standard comprehensive analyte list.*

Soil background *samples (0-1 ft bgs) will be collected at previous background locations as follows:*

- *Soil sample locations SS015XXBKX through SS019XXBKX*
- *Soil sample location BS021REF*

Surface water and sediment background *samples will be collected and submitted for laboratory analysis for the standard comprehensive analyte list at the following locations:*

- *Sample locations SW001XXBKX through SW004XXBKX and SW014XXBKX for surface water, and*
- *Sample locations SD001XXBKX through SD004XXBKX, SD014XXBKX, and BS012REF for sediment).*

The *proposed* soil, surface water, and sediment background locations are presented in Figures 3.2-1, 3.2-2, and 3.2-3, respectively. The proposed soil, surface water, and sediment investigation program to address these OU1 objectives are described in Section 4."

The general location of BS021 REF (soil) and BS012REF (sediment) was selected as both a background location and a reference location for toxicity testing (sediment and soil). The location is not within the boundaries of the Site and is located upstream of the Maple Meadow Brook wetland. There is no known migration pathway that would link Site-related constituents to surface soil or sediment at that location. There is no known knowledge of any activities at this location that could result in contamination and therefore raise uncertainty about the selection of this location as a background and reference location. A review of the analytical data for soil and sediment samples collected from that location indicates that chemical concentration ranges are generally consistent with those at other background locations. It is not appropriate to conclude that a relatively high concentration of only ammonia (a naturally occurring substance in wetland environments) in a sediment sample means that the location is an impacted sample location and not representative of background conditions. Soil and sediment samples will be collected and analyzed from these locations. Upon consultation with USEPA concerning the results, a decision will be made concerning the use of the data from those locations in the Site background data sets.

COMMENT

7. P. 10 of 50, Response to Comment No. 8f: EPA agrees with the response that Table 2c values will be used, with the condition that the concentrations be adjusted for current toxicity values, as planned by Olin in Section 4.5 of the FSP.

RESPONSE:

Comment noted.

COMMENT

8. P. 12 of 50, Response to EPA Comment No. 9e: In this comment, EPA requests that Olin perform a 42-day sediment toxicity test. Olin's written response is, "Comment noted." Subsequent statements in the work plan appear to be contradictory with regard to Olin's willingness to perform the requested toxicity test. It is EPA's understanding that Olin has agreed to perform the 42-day sediment toxicity test. Please verify in response to this comment, and modify the work plan to eliminate the inconsistent statements and provide the necessary details regarding the scope and methods for this toxicity test in Volume III-A. (EPA observed conflicting statements on pp. 4-1 of Volume I and pp. 15 of 19 of Table 3.2-1 of Volume I.) A complete citation for the test method to be used needs to be provided in addition to the criteria for selecting the sediment location for the toxicity test. Chemical analytical results should be used to identify the sample location for sediment toxicity test.

RESPONSE:

Olin will perform a 42-day chronic exposure Hyalella azteca whole sediment toxicity test for survival, growth, and reproduction for a South Ditch sediment sample. Page 4-1 of the Final Volume I lists the long-term toxicity test as a data gap to be addressed by the activities proposed in the RI/FS Work Plan. Table 3.2-1 of the Final Volume I describes the toxicity test on page 16 of 19 under Section VII. Ecological Assessment Objectives, Objective 6. Section 4.4.1 (Historical Sampling and Analysis, Nature and Extent) of the Final Volume III-A will be revised to include a complete citation for the test method to be used in addition to a description of the criteria for selecting the sediment location for the toxicity test. (See Response to Volume III-A, Comment 12.)

COMMENT

9. P. 24 of 50, Response to EPA Comment #12: This scenario discusses various hypothetic human exposure pathways. In that context, Olin's response states, "There are no plans to evaluate the use of DAPL material as a drinking water source in the BHHRA." EPA disagrees with this statement. DAPL is groundwater and as such concentrations of site-related constituents, representative of monitoring wells screened within the DAPL zone, should be used in the BHHRA. In support of this position, attached please find a copy of the Groundwater Use and Value Determination for the Olin Site recently prepared by the MassDEP consistent with EPA's 1996 Final Groundwater Use and Value Determination Guidance.

RESPONSE:

While there are no drinking water wells screened in DAPL material, a drinking water exposure scenario involving concentrations of site-related constituents representative of monitoring wells screened in the DAPL will be included in the BHHRA. The BHHRA will treat this exposure scenario is a hypothetical scenario.

With respect to the Groundwater Use and Value Determination for the Olin Site recently prepared by the MassDEP and the groundwater-related exposure scenarios for the BHHRA, the following comments are offered for USEPA consideration. Also, it was noted by Olin that the Use and Value Determination that was provided did not cite supporting information and was not presented on letterhead or other official documentation with insignia of the MassDEP. Olin would request copies of all supporting information utilized by MADEP to reach its determination.

Consistent with the 1996 USEPA Region I Guidance, the BHHRA exposure scenarios are not defined by the Value and Use Determination but rather by the State's groundwater classification (Massachusetts has an approved Comprehensive State Groundwater Protection Program). "In performing the human health Risk Assessment for the site, exposure scenarios will generally be based on the generally allowed uses under the state ground water classification system. Risk assessors should not vary their existing risk assessment procedures as a result of this policy, other than to consider exposures based on the state classification rather than the 1986 draft federal guidelines." The guidance states further, "The Use and Value Determination prepared by the States may be discussed as part of the exposure assessment section of the risk assessment. In other words, the use and value Determination may be used to place the exposure scenarios in perspective."

The exposure scenarios for the BHHRA will be based on the GW-1, GW-2, and GW-3 groundwater classifications as defined by the Massachusetts Contingency Plan (MCP). Drinking water exposure scenarios will be evaluated for areas of groundwater that are classified as GW-1 groundwater ***(either a "current drinking water source" area or a "potential drinking water source"*** *area as defined by the MCP).*

The discussion of groundwater classification in the State's Value and Use Determination document does not identify all of the GW-1 areas as defined by the MCP, and it does not accurately identify where groundwater would be categorized as GW-2 as defined by the MCP. Additionally, it does not specifically identify groundwater areas that are Category GW-3. Therefore, the specific areas that are identified as Categories GW-1, GW-2 (based on currently available depth to groundwater information and current and planned land use), and GW-3 as defined by the MCP are identified in the attached figures. These figures serve as the basis for identification of potential groundwater exposure scenarios and potential exposure points for the BHHRA and BERA.

Figure 1 (attached) identifies those areas of groundwater at or surrounding the Site that are classified as GW-1(current or potential drinking water source) as defined by the MCP. Those areas have been designated as GW-1 either because they are within the Zone II of a public water supply or because they are within 500 feet of a private water supply well (the latter regulatory criterion was not mentioned in the State's Value and Use Determination).

Figure 2 (attached) identifies the groundwater areas that are identified as Category GW-2 per the MCP (areas where vapor intrusion should be evaluated). These areas are areas where the potential for vapor intrusion from groundwater to indoor air should to be evaluated. These groundwater areas characteristically have an annual average depth to groundwater of 15 feet or less and are within 30 feet of a current or planned occupied structure. Obviously, if there are no volatile organic compounds detected in a given area, the vapor intrusion potential is negligible and no further evaluation is necessary.

In the absence of a specific planned redevelopment of the former facility and in the interest of evaluating remedial/construction requirements related to potential vapor intrusion requirements for future redevelopment, the buildable portions of the former facility where annual average depth to groundwater is 15 feet or less will be evaluated in the risk assessment with respect to potential vapor intrusion pathway. In other words, groundwater beneath the buildable portions of the former facility property will be evaluated in the risk assessment as Category GW-2. Buildable portions (occupied buildings) of the former facility property do not include wetlands, surface water features, the Calcium Sulfate Landfill, the Slurry Wall/Cap Area, and the Conservation Area south of the South Ditch. As with the GW-1 areas that are based on existing private wells, groundwater quality for shallow groundwater that is hydraulically up-gradient of GW-2 areas would need to be considered in the evaluation of future conditions at those GW-2 (vapor intrusion) locations.

Consistent with the Statement of Work, vapor intrusion potential for groundwater will be evaluated in a manner consistent with the USEPA 2002 Vapor Intrusion Guidance and subsequent guidance documents. The site-specific risk calculation approach is consistent with both CERCLA and the MCP. Consistent with the MCP, when the site-specific risk calculation approach is applied (analogous to MCP Method 3 risk assessment), the MCP Method 1 and Method 2 GW-2 groundwater standards would not be applicable and would not be ARARs (the site-specific risk calculations would prevail). In the BHHRA, a site-specific risk calculation approach will be utilized. The calculated risks will be relied upon (no vapor intrusion ARARs have been identified for groundwater/vapor intrusion) to determine the need for groundwater remediation based on potential vapor intrusion from groundwater into buildings.

All of the groundwater at the Site would be considered Category GW-3 groundwater (potential for migration to and discharge into surface water). Groundwater impacts to surface water will

be evaluated in the RI and risk assessments for OU2. Although MCP Method 1 GW-3 standards may be utilized in screening groundwater areas for potential surface water ecological impacts, the GW-3 standards will not be considered ARARs for the evaluation of surface water risks for ecological receptors. The BERA will evaluate potential impacts of groundwater discharge on surface water quality. This BERA is analogous to a Method 3 ecological risk characterization under MCP requirements. When a Method 3 ecological risk assessment is conducted under the MCP to evaluate groundwater impacts on surface water, then the Method 1 GW-3 standards are not applicable. Therefore, since a BERA will be conducted, the GW-3 standards will not be considered ARARs. Massachusetts Surface Water Quality Standards will be considered ARARs for the evaluation of surface water impacts in OU2.

COMMENT

10. P. 4-1, Data Gaps/Needs: For OU1, the last bullet identifies the need to "characterize background conditions in all environmental media for all three OUs"; however, there is very little discussion of specific background sampling after this statement. The brief discussion on pages 3-4 and 3-5 in the FSP is inadequate. EPA notes that in Olin's response letter (dated April 29, 2009), Olin twice mentioned (pages 10 and 12) that they would resample previous background surface water and sediment locations. All proposed sampling activities (and analyses) should be presented in the FSP.

RESPONSE:

The text discussion of background conditions that appeared on page 3-5 has been revised as shown below. The soil, surface water, and sediment background conditions will be characterized by resampling and analysis of previous background sample locations (except re-sampling of soils from the GW-83D and GW-85D well installations is not proposed). The revised text is shown below (italicized).

"The RI will characterize background conditions by *re-sampling all* historical background *locations including soil,* surface water, and sediment locations as discussed below. Much of the background conditions information has been previously presented in the 1997 Supplemental Phase II Report (Smith, 1997). Attachment 3 of Appendix S of that report is the Characterization of Background Conditions. The following text *identifies the background locations where samples will be collected and submitted for laboratory analysis for the standard comprehensive analyte list.*

Soil background *samples (0-1 ft bgs) will be collected at previous background locations as follows:*

- *Soil sample locations SS015XXBKX through SS019XXBKX*
- *Soil sample location BS021REF*

Surface water and sediment background *samples will be collected and submitted for laboratory analysis for the standard comprehensive analyte list at the following locations:*

- *Sample locations SW001XXBKX through SW004XXBKX and SW014XXBKX for surface water, and*
- *Sample locations SD001XXBKX through SD004XXBKX, SD014XXBKX, and BS012REF for sediment).*

The *proposed* soil, surface water, and sediment background locations are presented in Figures 3.2-1, 3.2-2, and 3.2-3, respectively. The proposed soil, surface water, and sediment investigation program to address these OU1 objectives are described in Section 4."

The following sentences have been added to:
Section 4.1.2 of the FSP: "Additionally, background soil samples will be recollected from the historical background soil sample locations listed in Section 3.2 and shown in Figure 3.2-1."

Section 4.3.2 of the FSP: "Additionally, background surface water samples will be recollected from the historical background surface water sample locations listed in Section 3.2 and shown in Figure 3.2-3."

Section 4.4.2 of the FSP: "Additionally, background sediment samples will be recollected from the historical background sediment sample locations listed in Section 3.2 and shown in Figure 3.2-3."

COMMENT

11. P. 4-2, OU2 Data Gaps/Needs: The text on this page includes only one bullet for OU2, when in reality Olin has proposed to collect additional data from the East Ditch and MMB areas. Please add additional bullets to reflect the full proposed scope. In addition, EPA has reviewed the collective information provided by Olin with regard to the surface water bodies located south and southeast of the Olin property. EPA concludes that data gaps remain which must be evaluated to determine the full nature and extent of contamination in this area. Such activities

include the following;

- Install borings to map the previous lateral and vertical extent of the North Pond drainage area. Historic photographs should be used to guide boring locations.
- Collect soil/sediment samples from strata which appear most representative of the bottom layer of the former North Pond and preferably from the area which appears nearest to the former inlet.
- Collect sediment samples from the existing North Pond.
- Collect sediment and surface water data from Landfill Brook to determine if groundwater recharge has transported site-related constituents.

RESPONSE:

The OU2 data gaps/needs have been revised (revised or added text identified in italics) to state:

- "Additional sampling and analysis of surface water and sediments in the Maple Meadow Brook (MMB) wetland, East Ditch, off-Property West Ditch (off-PWD), Landfill Brook, and North Pond to provide a representative assessment of current conditions.
- Conduct investigations to better understand the impact of the cessation of pumping of the municipal water supply wells on surface water quality in the MMB wetland.
- Conduct investigation of the historic and current North Pond to delineate the previous lateral and vertical extent of the North Pond drainage area. Details of the proposed sampling plan have been provided in a separate addendum to the Work Plan

COMMENT

12. P. 4-2. OU3 Data Gaps/Needs: The bullet currently listed under OU2 for "cessation of pumping" should also be listed as a data gap for OU3.

RESPONSE:

The OU3 data gaps/needs includes a bullet that states:

- *"RI data will be evaluated to better understand the impact of the cessation of pumping of the municipal water supply wells on groundwater quality in the MMB wetland."*

COMMENT

13. P. 5-1. Final RI Work Plan: The text states that nine electronic copies of the final work plan will be submitted to USEPA, along with signed cover pages of the document volumes. EPA requests that seven hard copies of the Final RI/FS Work Plan also be submitted.

RESPONSE:

Section 5.1 of the Final Volume I Project Overview has been revised to state:

"Prior to final approval of the RI Work Plan and implementation of the RI activities, it may become necessary to modify proposed sampling and analysis activities and analytical methodologies to meet initial objectives of the RI/FS Work Plan and *to* resolve any outstanding conditions of approval by USEPA. When USEPA provides final approval of the RI/FS Work Plan, a final electronic copy (with nine duplicate copies) *and seven hard copies* of the work plan will be submitted to USEPA. Final signed cover pages of the document volumes will also be provided. This process will help ensure that document holders will have a complete and correct copy of the final approved Work Plan document."

COMMENT

14. P. 5-2, Spatial Analysis: The Procedures for evaluating surface and subsurface soil data to be collected during the RI should include a discussion on spatial analysis and its use in determining if contaminants are evenly or unevenly distributed across the former facility property. Such analysis will aid in the decision on exposure areas for the HHRA.

RESPONSE:

The following bullet will be added to Section 5.2 of the Final Volume I Project Overview:

- *"spatial analysis of surface and subsurface soil data which may involve contouring for selected site-related contaminants,"*

COMMENT

15. P. 5-4. Analytical Data Results: In addition to the procedures described on this page for the release and evaluation of RI data, validated results should be reported in Semi-Annual Status Reports on a rolling basis.

RESPONSE:

Comment noted. The Semi-Annual Status Report will include validated data that were not included in previously submitted Semi-Annual Status Reports.

COMMENT

16. P. 6-5, Ecological Risk Assessment (ERA) Deliverables: Olin states that the ERA, "shall be completed in accordance with current guidance, procedures, assumptions,

methods and formats ... ", and then lists 4 references. The following reports should also be considered, in addition to the 4 references presented, during the ERA process:

a. EPA (U.S. Environmental Protection Agency). 1993a. *Wildlife Exposure Factors Handbook.* Volumes I and II. Office of Research and Development. EPA/600/R- 93/187a, EPA/600/R-93/187b.

b. EPA (U.S. Environmental Protection Agency). 1998. *Guidelines for Ecological Risk Assessment.* Risk Assessment Forum. U.S. EPA, Washington DC. EPA/630/R-95/002F.

c. EPA (U.S. Environmental Protection Agency). 2007. *Framework for Metals Risk Assessment.* Risk Assessment Forum. U.S. EPA, Washington DC. EPA 120/R-07/001.

d. EPA (U.S. Environmental Protection Agency). 2003. *Generic Ecological Assessment Endpoints for Ecological Risk Assessment.* Risk Assessment Forum. U.S. EPA, Washington DC. EPA/630/P-02/004F.

e. EPA (U.S. Environmental Protection Agency). 2000 *Guidance for Data Quality Assessment: Practical Methods for Data Analysis.* Office of Information. EPA/600/R-96/084.

RESPONSE:

All of the aforementioned references have been added to the reference list on page 6-5 of Final Volume I Project Overview and will be referenced in the preparation of the BERA.

COMMENT

17. P. 6-6, BERAs: The text states that a Draft BERA for each OU will be submitted to USEPA. To clarify, a baseline ecological risk assessment is not required for OU3. Any impacts resulting from groundwater to surface water discharge should be evaluated in the BERA for OU2.

RESPONSE:

The text on page 6-6 of Final Volume 1 Project Overview has been revised (revised or added text in italics) to state:

"A Draft BERA for *OU1 and OU2 each* will be submitted to the USEPA after the completion and acceptance of the following three Interim Deliverables."

COMMENT

18. Table 2.0-1, Human Health Conceptual Site Model: EPA is in general agreement with the receptors and exposure pathways in this table; however, EPA is not familiar with

several of the receptor types listed in this table. It is also unclear which receptors are included for current exposures, future exposures or both? The exposure parameters associated with the listed receptors will need to be discussed in the first interim deliverable for the BHHRA (e.g. Visitor verses Area C Visitor. Community Resident verses Resident). The final work plan should also clarify that deed restrictions will be placed on the property to ensure that future property use remains commercial/industrial. EPA reiterates that there may be multiple exposure point concentrations for the on-Site, non Area C receptors, depending on the results of the proposed soil sampling and other analysis of historical data. EPA agrees that some of the exposure routes can remain "TBD" until future discussions can occur. Depending on the results of the RI field work, additional surface water exposure areas for OU2 may need to be considered (e.g. Maple Meadow Brook, Sawmill Brook, North Pond, and/or Landfill Brook).

RESPONSE:

The following footnote will be added to the table: "This preliminary human health conceptual site model will be revisited when the RI data are compiled and summarized and the spatial distribution of contaminants is evaluated. There may be revisions made to the receptor groups, exposure areas or exposure points, and exposure pathways and, if made, these revisions would be incorporated into the First Interim Deliverable for the BHHRA."

The receptor groups will be fully explained in the First Interim Deliverable for the BHHRA. In that deliverable, the current and potential future exposure scenarios will be clearly identified. Proposed exposure parameters for each exposure scenario will also be included in the First Interim Deliverable for the BHHRA. In the previously submitted preliminary human health conceptual model, the term "community resident" was used instead of "resident" to avoid giving the mistaken impression that a potential future resident would be evaluated for the facility property. These types of details will be more fully described in the First Interim Deliverable for the BHHRA.

The following text will be added to Section 2 of the Final Volume I Project Overview:
"There will be deed restrictions implemented to insure that the portion of the former facility property located to the north of the South Ditch and the Calcium Sulfate Landfill would remain in industrial/commercial use in the future. The deed restrictions would prohibit more sensitive land uses without prior assessment of health risks for any such uses. The portion of the facility property located area south of the South Ditch is subject to land use controls as described in the "Environmental and Open Space Restriction."

It is agreed that if the RI determines that there are additional exposure points (additional complete migration pathways) for OU-2 surface water and/or sediment exist beyond those identified to date, the risk assessments would need to address them.

COMMENT

19. Table 2.0-2, Ecological Conceptual Site Model: Depending on the results of the RI field work, additional Ecological Exposure Areas for OU2 may need to be considered (e.g. Maple Meadow Brook, Sawmill Brook, North Pond, and/or Landfill Brook).

RESPONSE:

Comment noted. The ecological exposure areas are based on the current understanding of the physical CSM, and additional exposure areas may be considered based on RI data.

COMMENT

20. Table 4.2-1, RAOs: The Potential Remedial Action Objectives listed in column 2 should also include the risk management criteria of the Massachusetts Contingency Plan (MCP).

RESPONSE:

The "adequately regulated" provisions of the MCP are designed to reduce regulatory overlap and duplication. These provisions limit the applicability of the MCP in cases where response actions are adequately overseen by other authorities. The CERCLA risk management criteria represent appropriate objectives for the table. This is consistent with other Massachusetts CERCLA sites.

COMMENT

21. Table 7.0-1,2 and 3, ARARs: For the purpose of the RI/FS Work Plan, the "Actions to be Taken to Attain Requirement" are sufficient. However, for the Feasibility Study Report, the actions provided are too generic and will need to be written specific to the site conditions. For now, please insert the following ARARs:

    Table 7.01 - Action-specific ARARs:

    1. State surface water discharge permit program, 314 CMR 3, and NPDES, which may be applicable in the event the remedy requires discharges to surface waters.
    2. State groundwater discharge permit program, 314 CMR 5, which may be applicable in the event the remedy requires discharges of pollutants to groundwater.
    3. Federal general pretreatment regulations for existing and new sources of pollution, which would be applicable in the event of a discharge to a POTW, 40 CFR 403.
    4. NESHAPs, 40 CFR 61, which would apply in the event of emissions of

hazardous air pollutants, and the state air pollution rules, 310 CMR 7.00, e.g. 7.09 (dust) and 7.18 (VOCs). Please also add a cite to 310 CMR 40.0049, which applies to air emissions from remedial activities.

5. Underground injection control program, 40 CFR 141.148, which forbids injections that would cause a drinking water regulation violation; also include the state program, 310 CMR 27. The substantive part of these regulations would be applicable in the event of a remedy involving underground injections.

Table 7.0-2 - Chemical specific ARARs:

1. EPA's guidelines for carcinogen risk assessment and EPA's supplemental guidance for assessing early life exposure to carcinogens, both published in March 2005. Both are TBCs.
2. AWQCs are relevant and appropriate, rather than applicable.
3. State surface water quality standards, 314 CMR 4.00 (generally the same as AWQCs).
4. State drinking water standards 310 CMR 22.00 and the state drinking water guidelines.
5. Broaden the reference to the MCP, to include the Method 1 and Method 2 standards as TBCs.
6. EPA health advisories.

Table 7.0-3 - Location-specific ARARs:

1. Delete the references to the CFR for the executive orders on wetlands and floodplains. Executive orders are no longer appended to the CFR.
2. The vapor intrusion citations should include a citation to the MCP GW-2 regulation, 310 CFR 40.0983.

RESPONSE:

Table 7.0-1: The potential action-specific ARARs have been added to the table.

Table 7.0-2: Items 1 through 3 have been added to the table. For item 4: State drinking water standards at 310 CMR 22.00 will be added as applicable requirements. However, the state drinking water guidelines are not promulgated and are not legally enforceable. These will be identified as "to be considered". For item 5: The Superfund remedial investigation approach will include a risk calculation approach that is analogous to the MCP Method 3 risk assessment approach. Per the MCP, if a Method 3 human health risk assessment is conducted; the Method 1 and method 2 soil and groundwater standards are not applicable. Consistent with that approach, given the nature of the BHHRA, MCP Method 1 and Method 2 standards are not relevant.

Table 7.0-3: References to the CFR for the executive orders on wetlands and floodplains have been deleted. Item 2: This portion of the MCP is not a separate regulation and the Statement of Work indicates that the vapor intrusion pathway should be evaluated per the 2002 USEPA Vapor Intrusion Guidance and associated updates. The "adequately regulated" provisions of the MCP are designed to reduce regulatory overlap and duplication. These provisions limit the applicability of the MCP in cases where response actions are adequately overseen by other authorities. The Adequately Regulated Fact Sheet 1 and Fact Sheet 2 (both revised by MassDEP in 2004) discuss the State's approach to the "adequately regulated" provision in general and for CERCLA sites respectively. These formal policies indicate that as the State is participating in the Superfund process, the State would request that certain requirements be incorporated into the ARARs and remedial decision-making as appropriate. Given the clear directive in the Statement of Work, it is assumed that the Site is adequately regulated under the CERCLA process with respect to vapor intrusion.

Volume II

COMMENT

1. P. 3-3, Site Security: The text states that access to off-Property areas will be allowed only to authorized representatives of Olin and USEPA. To clarify, EPA considers the Town of Wilmington, The Wilmington Environmental Restoration Committee (WERC), MassDEP, and Nobis Engineering (and their sub-contractors) to be authorized representatives of USEPA for activities related to the RI/FS.

RESPONSE:

Section 3.2.2 of the Final Volume II Site Management Plan and Community Relations Support Plan will be revised in part to read:

"When RI/FS activities are conducted at off-Property locations, access to these areas will be allowed to only authorized representatives of Olin, USEPA, and MassDEP."

It is Olin's intent to secure access agreements for off-Property locations where RI investigation activities are required. The agreements will include access for USEPA, MADEP its' employees, consultants, contractors, subcontractors, and their representatives. While this provision for access will be included in the agreement, Olin expects that USEPA will bear the responsibility and liabilities for these individuals acting as their authorized

representatives. This responsibility would include but not be limited to such things as, OSHA 40 hr. training/medical monitoring, insurance coverage and scheduling of access for these representatives to these off-Property locations.

Volume III-A

COMMENT

1. P. 2-2, Site History: In addition to Plant B and the containment area, construction of the South Ditch weir and West Ditch culvert should also be discussed in this section as significant historic actions. The impact of these structures on area hydrology will need to be discussed in the pending remedial investigation reports.

RESPONSE:

Section 2.1 Site History in the Final Volume III-A Field Sampling Plan will be updated to include additional background on the South Ditch weir and West Ditch culvert.

COMMENT

2. P. 2-4, Source Areas: Please add the following former site features to the list of "Additional potential sources;"

   - non-contact cooling water outfall;
   - urea silo;
   - "gypsum" sludge layer;
   - former or existing sumps, floor drains, and utilities below buildings; and
   - disposal pit/central pond (unlined)

RESPONSE:

The urea silo, the non-contact cooling water outfall, and the former or existing sumps, floor drains have been added. Subsurface utilities are included in the list of "Additional potential sources" listed in the Draft Final Volume III-A Field Sampling Plan.

Clarification is requested concerning the identity of the "gypsum" sludge layer. That bullet has not been added to the list of "Additional potential sources" at this time.

The disposal pit/central pond was remediated as part of the Construction RAM conducted and overseen by MassDEP in 2000. This area no longer remains a potential source area.

COMMENT

3. P. 2-8, Current Migration Pathways: Please add the following bullets (in no

particular order);

- Determine if migration of constituents within the Calcium Sulfate Landfill is occurring to surrounding groundwater.
- Migration of impacted groundwater to active area supply wells.
- Potential migration of impacted groundwater discharge to Landfill Brook and the surrounding wetland area.

This section of the Conceptual Site Model should also include a brief discussion of potential regional flow changes as a result of the cessation of pumping from the municipal supply wells located within MMB.

RESPONSE:

The following additions will be made at the end of the subsection titled Current Migration Pathways and Mechanisms on Page 2-8.

- *"Migration of dissolved constituents from the Calcium Sulfate Landfill (CSL) in groundwater to the northeast and southwest from the groundwater divide that bisects the CSL;*
- *Migration of impacted groundwater to active area supply wells; and*
- *Potential migration of impacted groundwater and discharge to Landfill Brook and the surrounding wetland area in the headwater area of Landfill Brook."*

As described in the FRI Report the water chemistry associated with both the Calcium Sulfate Landfill (CSL) and the Woburn Sanitary Landfill (WSL) has been previously studied. In 1999, Olin conducted a geochemical assessment of the groundwater data at the CSL to discriminate between groundwater related to the CSL and other potential sources of groundwater impacts such as the WSL which abuts the CSL (Geomega, 1999- Olin Wilmington Technical Series IV. Geochemical Discrimination Between Groundwater Emanating from the Calcium Sulfate and Woburn Sanitary Landfills.). Since the CSL is a monofill of calcium sulfate mineral precipitates (gypsum), general water quality impacts are primarily soluble calcium and sulfate in a stochiometric ratio consistent with mineral chemical composition, and solubility which should approach the theoretical stochiometric ratio of 0.4:1.0 expected from the leaching of gypsum. Evaluation of calcium to sulfate ratios from groundwater samples surrounding the CSL indicates that CSL impacted groundwater is limited to the immediate vicinity of the CSL. The WSL is an unlined landfill and is orders of magnitude larger than the CSL and has its own groundwater impacts that are more likely to have a dominant affect on the water quality in Landfill Brook.

After cessation of pumping of the municipal water supply wells, a monitoring program was established to evaluate changes in solute concentrations in shallow, medium and deep well pairs in MMB. The most recent monitoring results were statistically evaluated in the Appendix E of the FRI Report. Synoptic water level data collected for the RI will be used to assess changes in groundwater flow patterns and gradients that have occurred since cessation of pumping. These data will be compared to earlier data contained in the Supplemental Phase II Report. Based on available, non-synoptic water level data, the cessation of pumping has resulted in relatively minor increases in average water levels in MMB, and reduction of vertical gradients from bedrock to overlying deep groundwater. Current groundwater flow pathways will follow the bedrock valley that constrains the overburden aquifer underlying the MMB.

COMMENT

4. Pp. 2-5 to 2-9, Migration Pathways: When the FSP discusses Migration Pathways, it is almost the same discussion as presented in the Fate and Transport section; however, the following information is not included:

   - vertical and horizontal gradients and how these gradients playa role on COC transport across the disposal site and within the DAPL containment area;
   - existing and former utilities and drain lines from process areas; and
   - the varying location of the ground water divide (i.e., is there enough monitoring data to evaluate the effect of the varying location of the ground water divide on COC distribution and transport?).

   Please insert these statements consistent with the Fate and Transport section.

RESPONSE:

Volume III of the RI/FS Work Plan does not have a section titled "Fate and Transport".

The introductory text in the subsection titled Current Migration Pathways and Mechanisms on Page 2-8 will be modified as follows (revised or added text in italics): "Current migration pathways are less numerous than historical ones given there are no longer liquid waste disposal to the land surface and the Plant B Treatment System continues to operate. *Migration pathways in groundwater will consider the location of groundwater divides, vertical and horizontal gradients, and how those divides and gradients affect solute migration throughout the Site.* The migration pathways that will be further assessed or monitored by RI activities include:"

In addition the following bullet will be added to the bulleted list of migration pathways to be assessed or monitored.

- *"Existing or former utilities and drain lines from process areas located within the former Facility;"*

COMMENT

5. Section 3.1, Hexavalent Chromium: In development of the target analyte list for the RI, analysis for hexavalent chromium is included for soil and sediment. In review of the proposed soil sample locations in Figs. 4.1-1 and 4.2-1, the extent and locations for proposed analysis of hexavalent chromium appears adequate, particularly in consideration of the historic total verses hexavalent chromium results as presented in Table 4.1-5 of the FRI Report. However, EPA does not *believe* it is appropriate to extend this comparison to other media. Conditions may be favorable for the formation of hexavalent chromium in other media. According to Table 5.2-1, hexavalent chromium was detected at sample location NPSED-1 at a concentration well above background. Total chromium at this same location was elevated, yet much lower than on-property total chromium results from the lower South Ditch. Elevated total chromium has also been observed in the adjacent and down stream sediment in East Ditch and in the Off-Property West Ditch. According to Table 4.3-2, sediment analysis for hexavalent chromium is proposed only in samples from South Ditch. Hexavalent chromium analysis should also be performed in a sub-set of the sediment samples from the East Ditch, the Off-Property West Ditch and North Pond. Co-located hexavalent chromium analysis should also be performed from surface water samples in these areas (a minimum of one surface water sample for hex analysis should be proposed for each surface water body with the understanding that if hexavalent chromium is confirmed at concentrations above screening levels, additional hex chromium analysis for surface water may be needed. Hexavalent chromium analysis is currently not proposed for groundwater, yet according to Table 6.2-2, hexavalent chromium has been detected in 7 of 28 historic samples at concentrations well above Mass GW-1 and GW-3 standards. Additional hexavalent chromium analysis should be proposed to ensure sufficient data exists for the OU3 RI. Please add the requested hexavalent analysis to the appropriate samples for sediment, surface water and groundwater, and provide a brief discussion of hexavalent chromium in Section 3.1.

RESPONSE:

Hexavalent chromium analysis will be added to one sample in the East Ditch and one sample in the Off-Property West Ditch. Sediment and surface water samples at location EDSD/SW5 (EDBS11) will be analyzed for hexavalent chromium. Sediment and surface water samples at location OPWD-SD/SO/SW-S will be analyzed for hexavalent chromium.

Hexavalent chromium analysis will be added to groundwater locations with the "Additional Site-Specific Analysis" proposed as shown in Figure 6.2-39. A total of 85 groundwater locations will be analyzed for hexavalent chromium.

COMMENT

6. P. 3-2, Top Para: Appears to be a typographic error in the following sentence, "An analytical method is not available for water matrices." Please delete the word "not."

RESPONSE:

Sentence in Section 3.1 of the Final Volume III-A Field Sampling Plan was revised to state:

"An analytical method *is available* for water matrices."

COMMENT

7. Pp. 3-4 to 3-5 Background:

   a. Even though the FSP mentions use of Industri-plex background soil samples on pages 3-4 and 3-5, these background samples are not shown on the soil background figure (Figure 3.2.1), nor on any previously submitted data tables. These samples should **not** be included in the background dataset for the Site.

   b. Although listed as background soil locations, soil background samples collected during the installation of monitoring wells GW-83-D and GW-85-D are not shown on the background soil figure. Note that groundwater from GW-83-D is contaminated; therefore, soil data from this location may also be impacted and is suspect as a suitable background sample location.

   c. See Volume I comment above regarding historical background soil location BS021 REF and sediment location BS012REF.

RESPONSE:

Please see responses to Comments 6. and 10. for Volume I above.

COMMENT

8. P. 3-7, Groundwater Sampling Objectives: In addition to the listed objectives, please add the following bullets;

   - Assessment of groundwater quality in residential and commercial supply wells in areas potentially located within the downgradient extent.

   - Assessment of surface water and groundwater interaction in Landfill Brook by measuring the gradient between groundwater and surface water at specific locations.

   - Evaluation of the rate of diffusion and other transport mechanisms controlling the migration of contaminants between the DAPL zone, the diffuse zone, overlying groundwater and bedrock groundwater.

RESPONSE:

The following bullets will be added to the groundwater sampling objectives:

- *"Assessment of groundwater quality in active residential and commercial supply wells in areas potentially located within the down gradient portions of the Site.*
- *Assessment of surface water and groundwater interaction in Landfill Brook by measuring the gradient between groundwater and surface water at specific locations."*

Evaluation of the rate of diffusion and related transport mechanisms (geochemical partitioning, and geochemical speciation) controlling the migration of contaminants between the DAPL zone, the diffuse zone, and overlying groundwater is not a specific objective of this work plan as this information has already been thoroughly studied, and site specific diffusion coefficients have already been verified (see sections 2.7, 5.1 and 5.2 of the Supplemental Phase II Report by Smith, 1997). The mass flux of solutes to bedrock groundwater associated with the Main Street DAPL Pool has also been previously evaluated and the report provided to USEPA (Geomega 2001-Olin Wilmington Technical Series XVII, The Maine Street Bedrock Saddle Investigations).

The following text will be added to Section 5.1.2:

The work plan will add three sample locations in Landfill Brook. One in the headwater wetlands, one across from the WSL, and one upstream of the confluence of Landfill Brook with the East Ditch/New Boston Drainway system. A drive point piezometer will be installed at each location to measure water levels and surface water elevations to determine the hydraulic gradient between Landfill Brook and underlying groundwater. Surface water samples will be analyzed for the comprehensive analytical suite (VOCs, SVOCs, NDMA, inorganics and metals).

COMMENT

9. Sections 4.1 and 4.2, Soil Samples: The surface and subsurface (1-10 foot) sampling program appears to be generally consistent with EPA recommendations, however, the following changes are required:

   a. For the location designated as A7-Prop7 on Figure 4.1.1, surface soil analysis should include: VOCs, SVOCs, metals, and inorganics.

   b. For the location designated as A8-Prop6 on Figure 4.1.1, surface soil analysis

should include: VOCs, SVOCs, metals, inorganics, NDMA, DMF, phthalic anhydride, hydrazine, and diphenylamine.

RESPONSE:

The following analyses will be added to surface soil sample at location A7-Prop7: VOCs, SVOCs, metals, and inorganics.

The following analyses will be added to the surface soil sample at location A8-Prop6: VOCs, SVOCs, metals, inorganics, NDMA, DMF, phthalic anhydride, hydrazine, and diphenylamine.

COMMENT

10. P. 4-6, Section 4.2.3: In the second paragraph, please replace the Region 3 RBC table with the current EPA Regional Screening Level tables Levels (http://www. epa.gov/reg3hscd/risk/human/rb-concentration table/Generic Tables /pdf/master_usable_run_APRIL2009.pdf).

RESPONSE:

Section 4.2.3 in the Final Volume III-A Field Sampling Plan will be revised in part to state:

"To the extent possible, the decision to conduct laboratory analysis of the soil samples collected from greater than 10 feet bgs will depend on the laboratory results for the soil samples collected from the 1 – 10 foot interval. The analytical results for a soil sample collected from 1 – 10 feet bgs will be compared to the USEPA *"Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites"* for industrial land use and the Groundwater Protection Soil Screening Levels (risk-based) published in the *USEPA RSL* Table (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables /index.htm). For any analyte group (such as SVOCs), if all detected chemicals in that analyte group have associated *RSLs* and SSLs and all reported concentrations are below the corresponding *RSLs* and SSLs, then the sample collected from greater than 10 feet at that location will not be analyzed for that analyte group. If one or more chemicals in an analyte group has a reported concentration that is above either or both the *RSL* and SSL (or does not have *RSLs*), then the sample collected from greater than 10 feet at that location will be analyzed for that analyte group. A minimum of six soil samples collected from depths greater than 10 feet bgs in the areas of

the former unlined impoundments in the former production area will be analyzed for the standard comprehensive analyte list plus the "additional Site-specific analyte list". Those samples will be collected and analyzed to assess the potential presence of DAPL material."

COMMENT

11. P. 4-8, Section 4.3.3: The text states that "additional Site-related analytes" are identified in Table 4.3-2, but the specific list of inorganics that are included is unclear. Please clarify the analytes included in the category "inorganic" in this table by listing them in a footnote to Table 4.3-2. It is important to measure conductivity, and analyze surface water for ammonia as well as the inorganics that are elevated in DAPL.

RESPONSE:

The "additional Site-related analytes" are not inorganics. Rather, the "additional Site-related analytes" include: NDMA (low-level analysis), Opex®, Kempore®, EPH/VPH, nonyl phenol, DMF, phthalic anhydride, acetaldehyde/formaldehyde, hydrazine, and diphenylamine. Each medium has specific "additional Site-related analytes" as indicated in the Sampling Plan tables (Tables 4.1-1, 4.2-1, 4.3-2, and 6.2-4).

Soil and sediment samples will include analyses for the following inorganics: ammonia, chloride, and sulfate. Surface water and groundwater samples will include analyses for the following inorganics: ammonia, chloride, sulfate, nitrate/nitrite, and bromide.

COMMENT

12. P. 4-8, Sediment Program for OU 1: This section makes no reference to the 42-day toxicity test. As noted in the Volume I comment above, there are conflicting statements throughout the work plan regarding this text. Please clarify that the 42-day toxicity test will be performed in the Upper South Ditch area and insert the appropriate information into Section 4.4.

RESPONSE:

The following text has been added to section 4.4.1.

"Additionally, one location from the Lower South Ditch area will be selected for 42-day chronic exposure Hyalella azteca whole sediment toxicity testing for survival, growth, and reproduction. Sediment will be collected from the location with the highest hazard index (HI) based on existing data after the collection and chemical analysis of the samples currently proposed for the South Ditch.

HIs will be calculated by summing hazard quotients (HQs) calculated for each analyte. Maximum detected concentrations of each analyte will be compared to screening benchmarks in order to calculate an HQ.

$$HQ = \frac{\text{Maximum Concentration}}{\text{Benchmark}}$$

And

$$HI = \Sigma(HQs)$$

Toxicity tests will be completed according to the following guidance:

- *EPA/600/R-99/064: Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates, Second Edition (USEPA, 2000)."*

COMMENT

13. P. 4-13, Section 4.5.3: The text of this section does not contain some of the details in Figure 4.5-1, specifically the criterion that groundwater and/or soil concentrations must be 50 times higher than the Table 2c values in the 2002 EPA draft vapor intrusion guidance before indoor air data are collected (unless' semi-site specific evaluation of Figure 3a or Figure 3b attenuation factors indicates that Table 3c screening values are likely to be exceeded). EPA does not concur with this approach because it is unaware of the basis for this criterion and the location of the attenuation factors. Please provide an explanation of the basis for such a 50-fold criterion and the location of Figure 3a and 3b attenuation factors. In addition, Figure 4.5-1 indicates that Tier 1 consists in part of screening for occupied buildings, but the text indicates that vapor intrusion will be evaluated for potential future occupied buildings in the area that may be redeveloped. Vapor intrusion should be evaluated in all currently or potentially occupied buildings located within the study area.

RESPONSE:

Response: The comments will be addressed by the revised text for this subsection as shown below (revised or added text is in italics).

4.5.3 Vapor Intrusion Evaluation

The vapor intrusion pathway is being evaluated because the CSM for the Site (Figure 2.2-1 and Section 2.2) suggests that there may be some potential for a complete vapor intrusion pathway associated with volatile compounds in the subsurface under current and potential future land uses at the former Facility and the surrounding areas. It is ultimately necessary, if there is a

complete exposure pathway, to determine if the vapor intrusion pathway risks might be significant. The following technical approach will be implemented to investigate the potential vapor intrusion pathway for the Site (both on-Property and off-Property) and to generate the analytical data and other information necessary to include the vapor intrusion pathway into the BHHRA, if the pathway is determined to be potentially significant during the investigation. The vapor intrusion evaluation approach is discussed in the OU1 portion of the FSP consistent with the SOW that requires assessment of this potential pathway for both OU1 and OU3 as necessary. Subsurface soils and shallow groundwater are both potential sources of volatile compounds that might contribute to the vapor intrusion pathway at OU1. Shallow groundwater (not subsurface soil) would represent a potential source of volatiles for the vapor intrusion pathway at off-Property locations (OU3). Therefore, the vapor intrusion evaluation approach described here applies *to both* OU1 and OU3. The approach described below and outlined in Figure 4.5-1 is a step-wise approach that may include one or more of the following tiers of investigation/evaluation.

- Tier 1 – Primary Screening – determine if the pathway needs to proceed to Tier 2 (sufficiently volatile and toxic compounds are present in the subsurface and inhabited buildings are currently present, or could be expected to be present in the future, near volatiles in the subsurface).
- Tier 2 – Secondary Screening – for specific locations, determine if the vapor intrusion pathway is considered complete or incomplete (based on evaluation of groundwater and soil data). *This is considered a semi-site-specific evaluation.*
- Tier 3 – Site-Specific Pathway Assessment – if Tier 2 concludes it is necessary, collect and evaluate indoor air samples and also characterize background/ambient air quality.

4.5.3.1 Tier I Investigation

The nature and extent of VOCs and the more volatile SVOCs in shallow overburden groundwater will be characterized by groundwater sampling and analysis at the monitoring well locations discussed below. The proposed sampling locations provide spatial coverage of the areas on-Property where occupied structures could be placed. There is currently one on-ground occupied structure at the Property – the Plant B groundwater treatment building. The remaining buildings at the former Facility are not occupied, and the buildings that housed the former offices, laboratories, maintenance area, and pilot plant are not currently serviced by electricity. The temporary trailer at the Site is not constructed on-grade. The proposed sampling locations also provide spatial coverage of areas adjacent to the Property where occupied structures exist or could reasonably be expected. The proposed sampling and analysis program has been designed to characterize nature and extent of “volatile” compounds

in shallow groundwater at the Property and in nearby "down gradient" areas as shown in Figure 4.5-2.

Figure 4.5-2 identifies the occupied buildings at the former facility and in the surrounding area. The identification of occupied buildings is not an identification of impacted buildings, but rather identification of locations of potential vapor intrusion (in the event that volatile compounds are detected in shallow groundwater at those locations). The portion of the former Facility located to the north of the South Ditch (excluding the containment area, the identified wetlands, storm water retention basin, and the Central Pond) is considered a potential redevelopment area and it will be assumed in this investigation that occupied buildings could be constructed within that area in the future. There are currently occupied industrial/commercial buildings in the proximity of the Site located on Eames Street, Jewel Drive, Main Street (primarily the eastern side of the street), Woburn Street, New Boston Street and Breed Avenue. There are current residences in the proximity of the Site located at the eastern end of Eames Street, along the western side of Main Street, on Cook Avenue, and Border Avenue. Because of their proximity to the Site, these areas will be evaluated with respect to Site-related shallow groundwater impacts. Other occupied buildings further from the former Facility are less likely to have Site-related shallow groundwater impacts and are not considered in this vapor intrusion investigation.

The USEPA 2002 Vapor Intrusion Guidance states, "Additionally, we recommend groundwater concentrations be measured or reasonably estimated using samples collected from wells screened at, or across the water table." The sampling and analysis of groundwater to support the vapor intrusion pathway will be conducted at "shallow" monitoring wells that are screened across the water table or (at locations where no well is screened across the water table) within 5 feet of the water table. The water table is the locus of the transfer of vapors from groundwater to soil vapor in the unsaturated zone. Sampling of groundwater in the area of the water table therefore is appropriate for evaluation of the potential for vapor intrusion from groundwater. Sampling and analysis of deep groundwater rather than of shallow groundwater would not be appropriate for investigation of the vapor intrusion pathway. Groundwater samples will be collected from the monitoring wells identified in Table 4.5-1 and in Figure 4.5-2, to support the vapor intrusion investigation; these samples will be analyzed for VOCs and SVOCs.

Table 4.5-2 indicates what portion of the Site will be evaluated by each sampling location (for example, "future on-Property industrial/commercial area"). As shown in the table and in Figure 4.5-2, the proposed sampling program provides spatial coverage of the area north of the South Ditch at the former Facility (future industrial/commercial use), the Jewel Drive area (industrial/commercial use), the Eames Street area (primarily industrial/commercial), the Main Street area (mix of residential/industrial/commercial use), and the Woburn Street/New Boston Street area to the east of the former Facility (primarily industrial/commercial land use). The Cook Avenue and Border Avenue area will be evaluated by the shallow monitoring wells located at the southwest corner of the former facility property, since those wells are upgradient of these two areas.

The data (list of detected compounds) will be used to determine, consistent with the USEPA 2002 guidance, if there are substances in the subsurface that are sufficiently volatile and sufficiently toxic to potentially result in cancer risk greater than 10^{-6} and/or a non-cancer hazard index greater than 1. Historical data suggest that there are compounds present in shallow groundwater that are sufficiently volatile and sufficiently toxic to represent a potential vapor intrusion pathway. Table 1 of the USEPA 2002 guidance lists compounds that are sufficiently "volatile and toxic" and that table will be used to identify locations or areas where further vapor intrusion screening will be conducted. A similar screening will be conducted for unsaturated zone soil to identify locations or areas where further vapor intrusion evaluation will be conducted. Figures 4.1-1 and 4.2-1 indicate the locations of on-property surface soil (0 – 1 foot bgs) and subsurface soil (primarily 1 – 10 feet bgs) samples that will be analyzed for VOCs and SVOCs.

4.5.3.2 Tier II Investigation

The process will continue after areas are identified where there are compounds of sufficient volatility and toxicity in shallow groundwater and where there is also an occupied building or where an occupied structure could likely be present in the future. The next step will be to compare maximum detected concentrations in shallow groundwater of each VOC and sufficiently volatile and toxic SVOCs to the groundwater screening values in Table 2c of the 2002 USEPA Vapor Intrusion Guidance. All compounds with maximum concentrations lower than the vapor intrusion-based groundwater screening values will be eliminated from further consideration. For the remaining compounds, chemical concentrations (one well at a time) will be compared to groundwater screening values in Table 2c of the USEPA's Vapor Intrusion

Guidance of 2002 (values from the table will be updated by Olin if toxicity values have changed since 2002 and the risk-based concentrations calculated by USEPA Region 1 (2002) will replace the MCL-based values that are in the 2002 table). For compounds detected in groundwater that are not included in Table 2c of the 2002 guidance, Olin will determine if they are sufficiently volatile and toxic and calculate appropriate screening values consistent with the 2002 guidance.

The groundwater screening values listed in Table 2c of the 2002 guidance are based on an assumed residential land use and associated exposure scenario. When evaluating industrial/commercial buildings with the Table 2c screening values, the evaluation is likely more conservative than is necessary to protect human health for non-residential exposure scenarios. The 2002 guidance recommends that for non-residential buildings, adjustments be made for non-residential exposure durations, building-specific air volumes and air exchange rates as well as other relevant factors. Consistent with the 2002 guidance, Table 2c screening values will be adjusted to reflect industrial/commercial exposure scenarios. Both Table 2c residential screening values and adjusted industrial/commercial screening values will be presented and will be applied in the screening of shallow groundwater analytical data. For a well with no concentrations above the Table 2c residential values, no additional vapor intrusion evaluation will be conducted.

For monitoring wells with groundwater samples that have no detected concentrations of sufficiently volatile and toxic compounds, the vapor intrusion pathway will be considered insignificant and will not be evaluated further. For a well with one or more compounds with concentrations above the updated and adjusted Table 2c screening values, additional vapor intrusion investigation will be proposed as described below.

If a groundwater concentration is more than fifty times the corresponding Table 2c groundwater screening value (as described in Question 5a of the 2002 Vapor intrusion Guidance), a Tier III site-specific evaluation, including indoor air testing (described below), will be conducted.

If a groundwater concentration is above the Table 2c screening level, but not more than fifty times the screening level, the semi-site-specific evaluation will continue per Question 5b through 5f of the 2002 Vapor Intrusion Guidance. This semi-site-specific evaluation is a two-

pronged approach that addresses groundwater and soil vapor data separately and sequentially.

Figure 3b of the 2002 Vapor intrusion Guidance will be consulted to determine the appropriate groundwater: indoor air attenuation factor to be used for comparing groundwater data to the target media-specific concentrations presented in Table 3c of the 2002 Vapor Intrusion Guidance. The use of this figure is described in item 2. on page 34 of the 2002 Vapor Intrusion Guidance. The comparison will be conducted per Question 5e of that guidance. If the groundwater concentrations are below the concentrations in Table 3c, the pathway will be considered incomplete.

If the groundwater concentrations are above the Table 3c concentrations and soil gas data are available, a comparison of soil vapor concentrations to Table 3c soil vapor will be conducted. Figure 3a of the 2002 Vapor Intrusion Guidance will be consulted to determine the appropriate soil vapor: indoor air attenuation factor to be used in the comparison of soil vapor data to the Table 3c concentrations. The use of this figure is described in item 2. on page 34 of the 2002 Vapor intrusion Guidance. If soil vapor concentrations are below the Table 3c concentrations, the pathway will be considered incomplete. If the soil vapor concentrations are greater than the Table 3c soil vapor concentrations, a Tier III site-specific evaluation will be conducted.

If the groundwater concentrations are above the Table 3c concentrations and soil gas data are not available, a Tier III site-specific evaluation will be conducted as described below.

4.5.3.3 Tier III Investigation

If a Tier III evaluation is needed, then an additional investigation work plan will be prepared to further evaluate the vapor intrusion pathway (Site-specific evaluation as identified in Figure 4.5-1). The additional investigation work plan would include any needed addenda to the QAPP. The additional investigation could potentially include the following elements:

- Soil Vapor Sampling and Analysis
    - Deep soil vapor samples between well and building
    - Sub-slab soil vapor samples
    - Soil vapor sampling directly above soils impacted by volatiles

- TO-15 analysis for VOCs
- Methods appropriate for lighter SVOCs

- Indoor Air Sampling and Analysis
  - 24 hr (at least two events)
  - TO-15 for VOCs
  - Methods appropriate for lighter SVOCs

- Conduct Johnson & Ettinger Vapor Intrusion Modeling to determine the need and the appropriate locations for further Site-specific sampling and analysis for the vapor intrusion pathway.

4.5.3.4 Soil Investigation

Areas where there are compounds of sufficient volatility and toxicity (per the 2002 guidance) in the unsaturated zone soil and there is also an occupied building or where an occupied structure could likely be present in the future will be identified. There is no indication, based on historical data, that there are Site-related VOC unsaturated soil impacts off-Property. Therefore, the evaluation of the vapor intrusion pathway relative to sources of volatiles in soil will be limited to the portions of the former Facility property where there are currently occupied buildings or where occupied building could reasonably be built under a redevelopment scenario (not in the conservation area south of the South Ditch and not in wetlands or within the containment area).

In areas where volatiles are detected in unsaturated zone soils, a work plan will be developed to further investigate the vapor intrusion pathway. Such a work plan may include soil vapor sampling or a modeling approach for evaluation of the pathway.

COMMENT

14. P. 5-1, OU2: The opening paragraph states that, "The OU2 sampling and analytical program will consist of *one* sampling event to collect surface water, sediment and stream gauging data from off-Property locations." However, according to other statements in the work plan including Section 5.1.3, *two* sampling events are planned. Please clarify and correct the text as appropriate.

RESPONSE:

Two surface water sampling events will be conducted, and one sediment sampling event will be conducted. The text in Section 5.0 of the Final Volume III-A Field Sampling Plan

has been revised to state:

"The OU2 sampling and analytical program will consist of *two* sampling events to collect surface water *and one sampling event to collect* sediment and stream gauging data from off-Property locations. The sampling locations and analyses are discussed in the following sections."

COMMENT

15. Section 5.1.2, Groundwater Discharge: The current surface water and sediment analyses proposed for Maple Meadow Brook appears to provide adequate spatial coverage for an initial characterization of contamination and subsequent evaluation of effects. However, there is concern that groundwater discharge may be occurring at localized positions throughout this wetland area and that impact at these groundwater/surface water transition zones may be missed. This concern also exists in the wetland area which extends from the southern portion of the Olin property, in the area between the Lower South Ditch and Landfill Brook. Based on EPA guidance for evaluating this potential scenario, EPA recommends that this potential migration pathway be addressed in the FSP (ECO Update/Ground Water Forum Issue Paper: *Evaluating Ground-Water/Surface-Water Transition Zones In Ecological Risk Assessments.* Office of Solid Waste and Emergency Response. Publ. 9285.6-17. EPA-540-R-06-072. July 2008. EPA also requests that Olin collect continuous surface water temperature data along Maple Meadow Brook, Sawmill Brook and Landfill Brook to identify areas of potential groundwater discharge in defined channels (particularly in the vicinity of GW 83D to GW 65D). This should be coordinated with the 11 surface and sediment locations listed on Figure 5-1-3. EPA also recommends a minimum of 7 locations; MMB (3 locations), SMB (2 locations) and LFB (2 locations). Surface water temperature profile data should be collected prior to analytical data with the intention to locate sample points in areas where groundwater is discharging to surface water.

RESPONSE:

Historical shallow groundwater and surface water analytical data does not support a conclusion that impacted groundwater is discharging to MMB. USEPA will need to clarify what it identifies as the wetland area between Lower South Ditch and Landfill Brook. Further in the comment, EPA states it recommends a minimum of 7 locations; MMB (3 locations), SMB (2 locations), and LFB (2 locations), however, as written, it is unclear what EPA is recommending.

The following paragraph will be inserted between the first and second paragraph in Section 5.1.2.

"Surface water temperature profiling will be conducted in MMB, Sawmill Brook and

Landfill Brook prior to collecting surface water samples. The purpose of the profiling is to identify potential point discharge locations of groundwater along the stream bottom. Proposed surface water sample locations will be adjusted based on this data to allow identified discharge locations to be monitored by collection of co-located surface water and sediment samples. A water quality meter temperature probe will be used to take measurements at approximately 50 foot stations recording temperature at the bottom of the stream channel. The temperature probe will be affixed to a staff with a disc shaped foot to allow consistent measurement elevations of about 6-inches from the stream bottom. Station locations will be recorded using a GPS system with sub-meter accuracy. Collecting a continuous temperature profiles is not feasible due to extreme difficulty in navigating Maple Meadow Brook and Sawmill Brook channels, and interfacing a temperature probe to a GPS system that would accurately reflect location of the instrument as it is moved in an upstream direction."

COMMENT

16. Section 5.1.3: The text indicates that all OU2 surface water samples will be analyzed for two or more "additional Site-specific analytes" as identified in Table 4.3-2. Please describe how the two or more analytes will be selected?

RESPONSE:

The "additional Site-specific analytes" for surface water include: NDMA (low level analysis), Opex®, Kempore®, EPH/VPH, nonyl phenol, DMF, phthalic anhydride, acetaldehyde/formaldehyde, hydrazine and diphenylamine. The selection of the "additional Site-specific analytes" was based on the historical data and the current understanding of the CSM. Table 4.3-2 identifies which analytes are included for analysis at each location.

COMMENT

17. P. 6-1, OU3 (Supply Wells): Section 6.0 discusses the nature and extent of groundwater contamination. There are numerous private supply wells located throughout the study area. These wells include; active residential water supplies, active irrigation wells, active and inactive commercial production wells, and inactive municipal supply wells. Olin has tested many of these wells in an ad hoc manner for more than 15 years now, and results have been used to delineate the extent of groundwater contamination. However, according to Table 6.2-4, testing is not proposed at any of these well locations during the RI field work. Section 6.0 should be revised to provide a complete discussion of the private well characterization effort; including a description of the historic testing, summary of

the results in tabular form, a comprehensive private well location figure and a proposal for additional efforts during the RI. Additional efforts should include, at a minimum, continued frequent monitoring of private wells where compounds potentially linked to releases from the Site have been detected, intermittent monitoring of other active private wells, a review of current municipal and other records to verify the locations of all known supply wells located within the OU3 study area, and a proposal to sample supply wells either not previously sampled or not sampled since 2003.

RESPONSE:

The historical residential sampling program was described in the Draft Focused RI Report (MACTEC 2007) in Section 2.1.6.2.4.1 located on page 2-80. That discussion included Table 2.1-13 which listed all samples and associated analytical programs for all residential well samples collected. The text in Section 2.1.6.2.4.1 described the sampling programs and listed all wells that were formally abandoned or decommissioned. Table 4.3-7 provided a tabular summary of analytes detected in residential wells. Olin views USEPA's characterization of this program as Ad Hoc as unfortunate since the term also has a negative connotation of being makeshift or inadequately planned. The reality is that Olin made a concerted voluntary effort over many years to conduct a comprehensive assessment of the location and status of residential wells and active commercial wells, and developed a comprehensive sampling program that was approved by the MADEP. The fact that the sampling locations and analytical program of the sampling effort evolved over time in response to other new data, shows Olin's commitment to making appropriate efforts to protect the public. At USEPA's request Olin provided all documents related to the residential well sampling effort, and USEPA commented it found that effort to be thorough and well documented. In 2008 when USEPA asked Olin if it would expedite additional residential well sampling in advance of the RI program, Olin very willingly worked with USEPA to identify some 24 locations to verify whether wells currently existed and obtain permission to sample those that did exist. Subsequently, Olin sampled all wells for which it could obtain permission to sample, and has re-sampled two wells to verify initial results.

In response to this comment, Olin will make the following changes to the Section 6 of the FSP. The following text at the end of section 6.2.6 (Sample locations will not include residential well locations that were sampled by Olin on an expedited schedule at the specific request and concurrence of USEPA. Additional residential well sampling is not proposed in this FSP) will be modified to state "Section 6.7 describes the historic and

proposed residential well sampling program. There are no active commercial or other public water supplies within the Site available for sampling."

The following text will be inserted as Section 6.7.

Section 6.7 Proposed RI Residential Water Supply Sampling

The residences that were sampled in 2008 and 2009, for which data does not indicate Site-related water quality impacts, will be re-sampled on an annual basis. The annual sampling program will include VOCs, SVOCs, metals, inorganics, and NDMA consistent with the proposed comprehensive analyte suite for OU3 groundwater. The residences where potential Site-related water quality impacts have been indicated by past sampling (wells M24/L54 and M24/L94) will be sampled on a quarterly frequency. Wells identified for sampling on a quarterly basis will first be sampled for the entire RI analyte list for two quarters. Analytes that are not detected would then be dropped from further testing. Such sampling would continue until USEPA approval of the RI Report.

COMMENT

18. Section 6.1.1, Seismic Refraction: An additional seismic refraction line should be completed in the area of the GW-400 quadruplet. This line should be placed to the west of the active rail road bed and extend northward from the intersection of the rail line and Main Street across Maple Meadow Brook, and continue some distance towards Butters Row. This seismic line is an addition to the line planned along Main Street to the east, and is intended to more accurately determine the placement and depth of the 400 and (if necessary) 404 clusters.

RESPONSE:

Olin will agree to conduct an additional seismic line but does not concur that the additional seismic line should be placed on the west side of the active rail road line. The proposed GW-400 well location is on the eastern side of the rail road line and the seismic line should be located on the eastern side of the track.

COMMENT

19. Section 6.1.3, GW-405: EPA generally agrees with the proposed location of GW-405BR, but is concerned that the well will not be installed deep enough to achieve the stated objectives. The proposed depth of 250 feet appears arbitrary. Given that the location of GW-405BR is on a knoll, and that the stated (undocumented) depths of private supply wells on Cook Avenue are greater than 300 feet, absent more specific information, EPA requests that GW-405BR be installed to an approximate depth of 350

feet bgs (final depth based on logging). EPA also requests that Olin geophysically log this well and complete as a Solinst installation to isolate what are likely to be several water-bearing fractures, and consider that an overburden well be paired at this location. Given the expected depths of the residential supply wells, installation of a single sample zone is inadequate to determine the nature and extent of Site-related contamination which may be migrating in a southwesterly direction.

RESPONSE:

Olin had initially proposed a shallower depth well (150 feet), and upon USEPA's request, the proposed well completion depth was revised to 250 feet. Olin believes this depth is adequate to achieve the stated objectives for the well. The bedrock elevation on top of the hill is approximately 60 feet higher than the bedrock elevation of the proposed well location. Thus a well drilled to 250 feet at the base of the hill is equivalent to a well drilled to 310 feet from the top of the hill. As stated previously, Olin intends to drill the well to 250 feet and geophysically log the borehole to determine the location, orientation, and hydraulic characteristics of water bearing fractures in the borehole. Olin will install two nested wells in the borehole. If the borehole geophysical data indicate a deeper depth is appropriate, it will make that decision at that time based on available data. The packer sampling will include static head measurements at each fracture interval packered, so relative heads between fracture zones can be assessed.

Olin will provide a detailed description of the well installation process, an SOP for packer sampling, and borehole geophysical logging with the Well Construction Addendum.

COMMENT

20. Section 6.1.3, GW-406: EPA remains concerned about the potential migration of contaminants to the west of Lake Poly. Taking into account the information to be gained from the seismic refraction line, EPA requests that the proposed location of GW-406 and GW-406BR be moved further south to a location just west of Lake Poly.

RESPONSE:

Olin consented to move this well further south previously and had done so in the Draft Final RI/FS Work Plan. One of the objectives of the well cluster was to bound the DAPL pools to the north. Rather than continue to move this well cluster to the south and jeopardize its original objective, Olin will propose another new well, completed to the bedrock surface west of Lake Poly. This additional new well will be located on the 4-6 Jewel Drive Property, if access can be obtained.

COMMENT

21. Section 6.1.4. Solinst: The criteria to be used to select the number of ports planned for each Solinst installation should be communicated. After the bedrock wells are drilled, and prior to Solinst well construction and installation, it is unclear how groundwater will be prevented from recirculating in the borehole. EPA has concerns that in areas of strong upward or downward gradients, contaminants associated with the Site may migrate to different aquifer zones from these temporary pathways until the final well installation is grouted in place. The details associated with the Solinst installation should be provided in the required well construction addendum per the condition cited above.

RESPONSE:

Olin has not committed to Solinst multiport installations and will provide discussion of proposed wells installation methods in the Well Construction Addendum.

COMMENT

22. P. 6-3, Bedrock Boreholes: This sections states, "Bedrock boreholes shall be geophysically logged to identify water bearing fracture zones." There is no discussion provided on which wells are to be logged and why. Please insert such discussion or provide a reference to other portions of the work plan that provide this detail. EPA requests that all newly installed bedrock wells be geophysically logged.

RESPONSE:

Olin will geophysically log each bedrock borehole, with the exception of GW-400BR which is intended to only monitor the first water bearing fracture zone, and is likely to only extend into bedrock a short distance. Since the borehole logging will be used to determine water bearing zones for well construction, such details will be provided in the Well Construction Addendum.

COMMENT

23. Table 3.1-1, TALs: The USEPA's National Exposure Research Laboratory previously collected samples from the site and published a study on November 4, 2004 titled, *"Study of Organic Chemical Compounds Present in Water Samples from the Town* of *Wilmington Maple Meadow Brook Aquifer'*. Fluoride and bromide were present at a relatively high rate of detection and one of the recommendations was that fluoride and bromide be added to the list of analytes for the Olin site. EPA Region I requests that fluoride and bromide be added to the list of existing anions as listed in Table 3.1-1.

RESPONSE:

The available site history does not indicate that fluoride was a raw material, waste product, or product at the facility. A review of the November 2004 study report, A Study of Organic

Chemical Compounds Present in Water Samples from the Town of Wilmington's Maple Meadow Brook Aquifer Study Area, did not identify any references to fluoride or fluoride compounds related to the groundwater sample analysis. It appears the reference to fluoride in the comment may be a typographical error. There appears to be no technical basis for adding fluoride to the RI Analyte List.

There is documentation that sodium bromide was used as catalyst in Kempore manufacturing operations at the facility. It is reported the waste contained hydrogen bromide. Hydrogen bromide is a gas, but dissolved in water becomes hydrobromic acid (also designated as HBr). In IRIS, there are two bromide compounds listed (cyanogen bromide and methyl bromide). There is no IRIS entry for the bromide anion or for hydrogen bromide or hydrobromic acid. There are no drinking water standards for bromide.

There is a drinking water MCL for bromate (disinfection by-product) of 0.010 mg/L but not for bromide. There is an IRIS file for bromate (BrO_3^{-1}). Bromic acid is $HBrO_3$.

There is an analytical method for the bromide anion. It is not clear that there is sufficient toxicity information upon which risk characterization could be completed. Nonetheless, bromide ion has been added to the RI Analyte List (Table 3.1-1).

COMMENT

24. Table 4.3-2, East Ditch sampling: Through review of the IRSWP, Olin has agreed to analyze East Ditch samples for EPH/VPH. These samples were/are to be collected as required during the planned Plant B reduced extraction rate pump test. There is currently no scheduled start date for the pump test. If the Plant B pump test is delayed beyond the RI field effort, Olin should collect the required EPH/VPH samples from surface water and sediment in East Ditch through the RI field effort. Either way, EPH/VPH data should be included in future RI discussions relevant to the East Ditch.

RESPONSE:

Comment noted. The East Ditch sampling as part of the RI will include EPH/VPH analysis, and sampling will begin as soon as an agreement has been reached with the MBTA.

COMMENT

25. Table 6.2-1: *Summary* of *Analytes Detected* indicates that GW-55S & D were not sampled for NDMA. This information corresponds to Figure 4.3-19 in the October,

2007 FRI report. However, Table 6.2-4 indicates that GW-55D was sampled for NDMA, and NDMA was detected. Please clarify. Also, Kempore has not historically been "detected" in wells E-10 and W-10 (installed in the east pit and west pit, respectively). However, based upon a review of Figure 6.2-18, it appears that Kempore was not "analyzed" in these two wells located in the east and west pits. Please clarify.

RESPONSE:

GW-55D has not been sampled for NDMA. The inconsistency in Table 6.2-4 will be corrected to reflect that GW-55D has not previously been sampled for NDMA.

Kempore® was analyzed for in both E-10 and W-10 on 11/23/99. However, during validation the result was rejected. The inconsistency between Figure 6.2-18 and Table 6.2-1 will be revised to reflect Kempore® was not analyzed.

COMMENT

26. Table 6.2-3, Specific Conductance: GW 55D is not included on this table. Was GW 55D ever tested for specific conductance? If so, please add the relevant information to this table.

RESPONSE:

Table 6.2-3 presents the most recent specific conductance result as measured by a lab. Specific conductance has been collected at GW-55D during each sampling event as a field measurement. In the RI, specific conductance analysis will be conducted for GW-55D.

COMMENT

27. Table 6.2-4, Calcium Sulfate Landfill: In EPA's opinion, the current monitoring program is not sufficient to determine if the CSL represents an ongoing source area. In lieu of installing borings in the CSL to characterize the nature and extent of contamination which may have been placed, testing for "additional Site-specific analytes" should be performed within the existing monitoring well network. EPA requests that this table be revised to add well locations SL-1 S, SL-1 D, SL-4, SL-5, SL-7, and SL-8; and that all SL-designated wells include "additional Site-specific analytes."

RESPONSE:

The request locations will be added to the groundwater sampling program. All of the SL-designated wells will include "additional Site-specific analytes" as shown in Table 6.2-4.

COMMENT

28. Section 8.1, Surface Soils: Section 8.1 states that *surface soils* are to be collected between zero and two feet bgs. Section 4.1 and Volume I, response to March 12 EPA letter Volume IIA, Comment #5 (page 35 of 50) describe surface soil as 0-1 foot. EPA reiterates that *surface soils* should be collected from 0 to 1 foot bgs during the RI. Existing soil samples collected from 0 to 2 foot bgs may be considered to be representative of surface soil conditions.

RESPONSE:

Surface soil will be sampled from 0 to 1 foot bgs during the RI. The text in Section 8.1 of the Final Volume III-A Field Sampling Plan will be revised in part to state:

"Surface soil samples will be collected by hand augering or from soil borings; subsurface soil samples will be collected from soil borings completed through foundations of former and existing buildings and other OU1 locations. Surface soil samples are to be collected between zero and *one foot* bgs. Subsurface soil samples will be collected to a depth of 10 feet bgs. This is a variance from the SOW which defines surface soil as zero to six inches and subsurface soil as six inches to ten feet bgs. Existing soil samples collected from 0 to 2 foot bgs will be considered to represent surface soil conditions."

COMMENT

29. Section 8.1.2, Sample Interval: Section 8.1.2 describes collection of *subsurface soils* from 1-10 feet bgs as composites from the entire 1 to 10 foot interval. However, a single 2 foot interval within the 1-10 foot range is required at each location rather than a 9 foot composite. The selection of the 2 foot interval to be analyzed should be based on PID readings, visual observation, and/or olfactory observation. If field observations do not lead to a clear choice, depths may be chosen at random and documented in field logbooks. Samples from immediately above the water table should be considered as preferable, however, EPA recommends some variation of depths to ensure spatial coverage across the Site.

RESPONSE:

The text in Section 8.1.2 of the Final Volume III-A Field Sampling Plan will be revised in part to state:

"At locations with multiple soil sample depths, the top sample will be collected from 0 – 1 foot bgs and then a 2-foot horizon within the 1 – 10 foot interval will be selected for

sampling based on PID readings, visual observation, and/or olfactory observation. If field observations do not lead to a clear choice, depths will be chosen at random and documented in the field books with preference given to samples immediately above the water table.

If VOC or VPH samples are scheduled for analysis from 2-foot horizon within the 1-10 foot interval (selected as discussed below), the VOC and VPH samples will be collected immediately following the 0-1 foot interval sampling, before samples for other analytes to avoid the loss of volatile constituents in accordance with SOP No. S-13 "Field Preservation of VOA and VPH Soil Samples". The remaining sample collection will continue in the same manner as described for the 0-1 foot interval. The appropriate sample container will be selected and the sample placed the sample in the container, capped and labeled, and placed into a cooler to initiate sample storage and preservation procedures.

To the extent possible, the decision to conduct laboratory analysis of the soil samples collected from greater than 10 feet bgs will depend on the laboratory results for the soil samples collected from the 1 – 10 foot interval. The analytical results for a soil sample collected from 1 – 10 feet bgs will be compared to the USEPA RSLs for industrial land use and the Groundwater Protection Soil Screening Levels (higher of the risk-based and MCL-based values) published in the RSL Table (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/ index.htm). For any analyte group (such as SVOCs), if all detected chemicals in that analyte group have associated RSL and SSLs and all reported concentrations are below the corresponding RSLs and SSLs, then the sample collected from greater than 10 feet at that location will not be analyzed for that analyte group. If one or more chemicals in an analyte group has a reported concentration that is above either or both the RSL and SSL (or does not have RSLs), then the sample collected from greater than 10 feet at that location will be analyzed for that analyte group. A minimum of six soil samples collected from depths greater than 10 feet bgs in the areas of the former unlined impoundments in the former production area will be analyzed for the standard comprehensive analyte list plus the "additional Site-specific analyte list". Those samples will be collected and analyzed to assess the potential presence of DAPL material."

Volume 111-B

COMMENT

1. The analytical methods were updated appropriately in the QAPP except for Sulfide. This is listed as method 376.1. As this is not an approved method for CWA and SDWA, and sulfide is being tested for surface water, this should be changed to SM4500502.

RESPONSE:

Sulfide is not specified for collection in the Field Sampling Plan. Sulfide was removed from the QAPP.

COMMENT

2. The QAPP cover page and title page should match.

RESPONSE:

The QAPP cover page and title page has been edited to match.

COMMENT

3. On worksheet #9b, the following items need to be changed:

   a. Please update the Human Health PAL values based on the recent May 19, 2009 update of the EPA Regional Screening Levels (http://www.epa.gov/req3hscd/risk/human/rb-concentration table/Generic Tables/pdf/master_sl_table_run_APRIL2009.pdf).

   b. The response indicated that the laboratory SOP was similar to EPA Method 310.1. It is assumed this was an error and the correct reference should be 350.1. The response further indicated that Method 310.1 (read 350.1) would be added to the ammonia worksheets. This has not been done.

   c. The response indicated that Selenium would be reported to the MOL to meet the PALs. In all cases where the MOLs are going to be used to meet the PALs, a standard at the PALs level should be analyzed by the laboratory to demonstrate that the reported level can be distinguished from zero.

   d. The response indicated that PALs are met by Method 6010 for soil and sediment and that the reference to method 6020 would be removed. Actually, the PALs are not met for Cadmium, Selenium, or Thallium, as stated in Section 7, because of matrix interferences, only ICP-AES will be used for the soils. However, the reference to method 6020 was not removed from worksheet #9d.

RESPONSE:

a. Noting that the guidance was updated after submission of the Draft Final RI/FS Work

plan: The Human Health PALs have been updated in the QAPP based on the May 19, 2009 USEPA Regional Screening Levels screening values.

b. *Method 310.1 was a typographical error in the QAPP. The method used for the analysis of Ammonia for this program is a lab specific method (QuikChem Method 10-107-06-1-A) that uses a LACHAT instrument. The QuikChem method is approved by USEPA as an alternative to method 350.1 and is referenced in the QAPP Worksheets.*

c. *Due to the complexity of the analytical program, it would not be practical to analyze standards at the PALs. The majority of the analytes where the PALs are between the MDL and reporting limit are not primary chemicals of concern. Regular instrument calibration standards at the quantitation limits will be analyzed as is routinely done for CERCLA investigations using USEPA methods.*

d. *Method 6020 was removed from the soil and sediment Worksheet 9bs.*

COMMENT

4. The response indicates that sampling method S-2 on worksheet #12b will be added to the worksheet when sediment samples are to be collected. If that is the case, then worksheet #11 should be similarly updated.

RESPONSE:

Sampling method S-2 will be added to Worksheet #11 when sediment samples are to be collected.

COMMENT

5. Worksheet #13: Add preservatives, as appropriate, to the Equipment Identification column for the sample containers.

RESPONSE:

Preservative(s) have been added to the Equipment Identification column of Worksheet #13, where appropriate.

COMMENT

6. The response indicates that Worksheet #22b will be removed from the QAPP. It was, but the reference to it in the Table of Contents is still in place and should also be removed.

RESPONSE:

Worksheet #22b has been removed from the Table of Contents in the QAPP.

COMMENT

7. Additional Comments to prior QAPP comments not addressed in communications:

a. Table 6.1, Summary of Analytical Methods and Media was added to the QAPP. This provides an excellent summary of all methods and media that are covered in the QAPP for potential sampling. Please add NOPA to this table.

b. There are several comments related to Section 7.1, where the PALs exceed the Quantitation Limits:

   i. For groundwater VOCs, Vinyl chloride should be added to the list of analytes that have the Quantitation Limits exceeding the PALs.

   ii. For groundwater SVOCs, N-Nitroso-di-n-propylamine should be listed, followed by a discussion that NOPA will be tested by an alternate method, 521, to achieve the PALs. Add to Table 7.1 also.

   iii. For surface water Metals, add Lead to the list of metals where the Quantitation Limits exceeds the PALs.

   iv. For sediment SVOCs, add Benzyl alcohol to the list of analytes where the Quantitation Limits exceed the PALs. Add to Table 7.1 also.

c. Worksheet #11, (p. 7-36). Nitrate and nitrite are not listed on the Analytic Parameter header of the table, even though they are listed in the Analytical Method section.

d. In Section 16, page 16-2 and 16-3, a discussion of the use of blind PE samples and data validation as technical system audits (TSAs) was included in the Draft QAPP but was omitted in the April 2009 version of the OAPP. Inclusion of blind PE samples and data validation should continue to be a part of the TSAs for this project, where applicable.

e. The SOP for Analysis of Pesticides references L-29 and L-30, but should only reference L-29 as there is no L-30 reference number in Worksheet #20. The list of SOPs in Appendix B includes a reference for L-31 but this reference number is not included in Worksheet #20 and is not an SOP in Appendix B.

RESPONSE:

a. NDPA has been added to Table 6.1 of the QAPP.

b.i. Vinyl chloride will be added to the list of analytes that have quantitation limits exceeding the PALs.

b.ii. NDPA will be added to Table 7.1 and a discussion will be added to the text to reference the analysis by Modified 521.

b.iii. Lead will be added to the list of metals where the quantitation limit exceeds the

PALs (Table 7.1).

b.iv. Benzyl alcohol will be added to the list of analytes where the quantitation limits exceed the PALs and to Table 7.1.

c. Nitrate and nitrite will be added to the header in Worksheet # 11.

d. Blind PE samples and data validation will be included in Section 16.1.1 Internal Assessment.

e. The reference to L-30 and L-31 will be removed from the QAPP.

Volume IV

COMMENT

1. The term "Site," as used in this plan, refers to both on-property and off-property areas that are affected by contamination. In most cases, the text appears to be more applicable for on-property areas where the property is secure and access is limited. There does not appear to be inclusion of the potential for the public to be in proximity to off-property investigative operations (such as Task 5 and Task 7). Adequate consideration should be included in this Health and Safety Plan for typical off-property, unrestricted access issues, such as noise impacts, investigation derived waste (IDW), and VOC vapors in off-property areas.

RESPONSE:

Sections 1.2.3; 3.3.9; 3.5.4.1; and 5.1 of the plan have been revised to include consideration of public safety during off-property investigation operations.

COMMENT

2. Section 1.2.3, Page 1-5: A bullet should be added to address issues of "public safety" for activities which occur in off-property areas of the Site.

RESPONSE:

Please refer to the previous comment. Additional provisions have been added to the plan to address issues of public safety for activities which occur in off-property areas of the Site.

COMMENT

3. Section 2.3, Task 8: This Task describes "Observing Handling soil-filled drums." Add a similar note to account for "Observing Handling drilling fluid drums" from development water from off-site wells. Also, for Task 10, insert "See note below this table" in column 1, consistent with the reference in Task 9.

RESPONSE:

Section 2.3, Task 8 has been revised to include observing handling drilling fluid drums. For Task 10, the text, See note below this table, has been added in column 1.

COMMENT

4. Section 3.5.4.1, Page 3-24: The text indicates benzene colorimetric tubes will be used if total VOC levels are sustained at 0.5 parts per million (ppm). Table 3-2 (in the notes), and Sections 3.5.4.1 and 3.5.4.3, indicate tubes will be initially used to screen for benzene if total VOC levels are at or above 1.4 ppm. Please clarify.

RESPONSE:

Table 3-2 (in the notes) and Sections 3.5.4.1 and 3.5.4.3 of the plan have been revised to reflect the correct action level of 1.4 ppm.

COMMENT

5. Section 8.4, Page 8-4: Please confirm that the listed telephone numbers for the police and fire departments are current.

RESPONSE:

A call was placed to confirm the police and fire telephone numbers listed in the plan. All of the telephone numbers listed under police and fire in the plan directs the caller to the central emergency center. The plan has been revised to reflect the numbers as obtained from the Wilmington Police Department dispatcher.

ADDENDUM I – NORTH POND INVESTIGATION

FINAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WORK PLAN

OLIN CHEMICAL SUPERFUND SITE
51 EAMES STREET
WILMINGTON, MASSACHUSETTS

Submitted to:
United States Environmental Protection Agency
Region I – New England
One Congress Street
Boston, Massachusetts 02114

Submitted by:
Olin Corporation
1186 Lower River Rd
Charleston, TN 37310

Prepared by:

MACTEC Engineering and Consulting, Inc.
107 Audubon Road
Wakefield, Massachusetts 01880

Project No. 6107-09-0016.01

August 14, 2009

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August 14, 2009

Peter Thompson
Project Manager

Michael J. Murphy
Project Principal

ADDENDUM I - NORTH POND INVESTIGATION

Considerable investigation and evaluation of the potential for Site impacts in the North Pond have been conducted previously. The investigations and evaluations have been documented in technical reports that were submitted to the Massachusetts Department of Environmental Protection (MassDEP) per requirements of the Massachusetts Contingency Plan (MCP). The following text summarizes the previous work activities and the proposed investigation as part of the Remedial Investigation/Feasibility Study (RI/FS).

1.0 BACKGROUND AND HISTORICAL SUMMARY

The following bullets provide highlights of the available information concerning the North Pond area.

- In 1955, the area surrounding North Pond was largely undeveloped.
- In the 1960s, properties on the west side of Woburn Street were developed. The property at 888 Woburn Street was developed in 1966 and operated as a drum and barrel reclamation facility from 1966 until 1987. That property is located between the Olin Chemical Superfund Site and North Pond. That property is a Massachusetts Contingency Plan Disposal Site. The un-named ditch identified in the 1955 aerial photograph was located on this property.
- Between 1966 and 1973 the area immediately north of North Pond was developed (south side of Industrial Way) and the railway spurs were constructed on filled land at the north edge of North Pond.
- North Pond was reworked and filled to construct Presidential Way and other portions of North pond were re-worked and filled to develop areas on the south edge of North Pond and on Presidential Way per a Superseding Order of Conditions issued by the Massachusetts Department of Environmental Quality in July 1984. That order indicated that 6,000 cubic yards of sediment would be dredged and that 60,000 square feet of the North Pond and wetlands would be filled to construct Presidential Way. The order indicated that dredged sediment would not be used as fill in the pond. For the construction of the roadway and the filling of the northern end of North pond and wetland areas, muck was to be stripped prior to filling (stripped muck not to be used as fill). In addition to the construction of the roadway, a four-acre marsh was to be constructed to contain no more than 12 inches of surface water under normal flow conditions. The Order indicated that filling may be required to meet this requirement. Based on comparison of the 1955 footprint of North Pond and the 2009 footprint, approximately 73% of the North Pond has been filled (and, based on the Superseding Order of Conditions, existing sediments in filled areas were removed from the pond prior to filling). The 1984 Superseding Order of Conditions also called for dredging of the southern portion of the North Pond (the current open water area between the dike at the southern edge of the pond and the peninsulas that were created in the pond) to elevation 62 feet so that the water depth would be eight feet. This would suggest that 1984

surficial sediments (and sediments from the 1953 – 1972 time frame) in the current open water portion of the pond would have been excavated and removed from the pond.

- In addition to the construction of Presidential Way and modifications of North Pond for flood storage purposes, portions of North Pond were filled to support the construction of commercial/industrial facilities immediately to the south of North Pond (on Woburn Street in Woburn) and along the southern edge of Presidential Way (approximately 450 feet east of Woburn Street).
- Conditions in the remaining area of North Pond have been characterized by studies by Olin and other parties.
- A 1998 investigation of the former Ritter Trucking Company (located at 856 Woburn Street - north of North Pond) included collection of two surface water and three sediment samples for chemical analysis from within North Pond (post-dating the construction of Presidential Way) and several additional surface water and sediment samples from the large surface drainage feature that flowed south/southwest into North Pond. This investigation was conducted by Roy F. Weston for USEPA. The report indicates migration of oil and hazardous materials had occurred from the Ritter Trucking Company site through surface water drainage features to North Pond. The location of the 1998 surface water and sediment samples are shown in Figure 1 (samples identified with the prefix "SW" and "SD" respectively) and the associated analytical data are shown in Table 1.
- There have been substantial changes to the physical configuration of North Pond during the last 37 years and there are many potential sources of oil and hazardous materials to the North Pond in what has become a heavily industrialized area. There is currently no visual evidence of any connection between the South Ditch or East Ditch and the North Pond. Visual inspections conducted on several occasions have not identified any culvert or opening beneath the rail line that separates the East Ditch and the Whitney Barrel property at 888 Woburn Street.
- Three separate field investigations of the North Pond were conducted by Olin between 2001 and 2005. The locations of the soil borings and sediment samples are also shown in Figure 1 (samples designated with prefix NPSB). These investigations attempted to identify and characterize former organic sediment in the inlet area of North Pond along the ditch from Whitney Barrel and along former margins and interior portions of North Pond. There have been several documents prepared and submitted to MassDEP and subsequently made available to USEPA concerning these investigations. These investigations verified the presence of fill material and a general absence of identifiable accumulations of former organic sediment, though some very thin layers with organic material were identified in some borings. These documents are listed below. The 2005 "Request for Additional Assessment- North Pond Study Area, 51 Eames Street Site, Wilmington, MA, RTN 3-0471" (Sleeman Hanley & DiNitto) summarizes the results and findings of the investigations and records searches.

GEI, 2002e. Ltr to Mr. Christopher Pyott. Re: Scope of Work, Investigation of North Pond Area. Wilmington, MA. RTN 3-0471, April.

GEI, 2002f. Report to Chris Pyott. Re: North Pond Study Area Investigation: Part 1. Wilmington and Woburn, MA. RTN 3-0471., December 16.

GEI, 2003e. To Chris Pyott. Re: Phase II Submittals Related to the North Pond Investigations (Part 2). Olin Corporation Site, Wilmington, MA. RTN 3-0471., February.

MACTEC, 2004a. Subject: North Pond Investigation Part II, Field Activity Report MACTEC, 2005. North Pond Investigation Part II Addendum, Field Activity Report, Olin Corporation, Wilmington, Massachusetts, January 18. (Attachment to Sleeman Hanley & DiNitto, 2004)

MACTEC, 2004b. North Pond Investigations, 51 Eames Street Site, Wilmington, MA, RTN 3-0471, August 17. This report contains the following attachments:

- Final Site Inspection Prioritization Report for Ritter Trucking Co., Wilmington, Massachusetts September 1998 prepared by Roy F. Weston, Inc. for USEPA.
- Public Health Assessment, Industriplex, Woburn, Middlesex County, Massachusetts CERCLIS NO. MAD076580950, prepared by Massachusetts Department of Public Health under a Cooperative Agreement with the Agency for Toxic Substances and Disease Registry, December 26, 1995.
- RE: Woburn/Wetlands #348-98, Superseding order of Conditions, Massachusetts Department of Environmental Quality, July 24, 1984.
- Review of EPA Report Titled "Wells G&H Site, remedial Investigation Report, Part I, Woburn, Massachusetts, Volume 2, prepared by GeoTrans, Inc., July 1987.

MACTEC, 2005. North Pond Investigation, 51 Eames Street Site, Wilmington, MA, RTN 3-0471, October 17. (Attachment to Sleeman Hanley & DiNitto, 2005)

Sleeman, Hanley & DiNitto, 2004. Phase II Submittals Related to the North Pond Investigations (Part 2), Olin Corporation Site, Wilmington, MA, RTN 3-0471, February 20.

Sleeman, Hanley & DiNitto, 2005. Request for Additional Assessment- North Pond Study Area, 51 Eames Street Site, Wilmington, MA, RTN 3-0471, October 18.

USEPA, 2002. Transmittal letter from Joseph F. Lemay to Christopher Pyott, MassDEP, "east Drainage Ditch Analytical Results and Map and Final Site Inspection Prioritization Report for Ritter trucking Company, Wilmington, MA", April 3.

The records search and field investigations conducted by Olin are summarized below. Following those summaries is a description of the proposed investigation of the North Pond that addresses Condition 4. of the July 16, 2009 Conditional Approval letter.

GEI Consultants, 2002. North Pond Study Area Investigation: Part I. December 16.

The investigation of the North Pond Study Area was focused around six main objectives. This study did not involve collection of environmental samples.

- Assess the function of the MBTA culvert and drainage ditches located near the confluence of the East Ditch and the South Ditch.
- Assess the source and nature of material used to fill North Pond – Based on comparison of aerial photographs, about one third of the North Pond has been filled since 1955 with unknown materials. Several properties and Presidential Way (public roadway) have been built within the 1955 extent of the North Pond.
- Confirm surface water flow direction in what appears to be, on a historical aerial photograph, a drainage ditch possibly connecting the North Pond to the east railway ditch – The potential drainage ditch was first observed on a 1955 aerial photograph in a wooded, wetland area north of the North Pond. The wooded, wetland area contributed runoff to the North Pond, but may have been partially filled or altered in 1966, during the development of the E.C. Whitney property. Based on historical aerial photographs, the report concluded that it is unknown whether an underground culvert may have been installed in lieu of the open ditch channel. Several properties located in this area directed storm water to the North Pond through open channels and storm water culverts.
- Conduct an information search and data review for the North Pond Area – The information search reviewed data from several sources including MassDEP files, USEPA documents, municipal files, and MADPH reports. The data review revealed that if contaminants are detected in North Pond surface water or sediment, there are several possible sources including contaminated surface water or storm water run off, contaminated groundwater discharge, or contaminated soil used as fill material. Several spills or releases on properties near the North Pond have been documented. Six groundwater wells are located in the vicinity of the North Pond. One investigation was conducted in 1998 by Roy F. Weston, Inc. for USEPA for Ritter Trucking Company located north of North Pond that evaluated surface water and sediment in the Pond. The report indicated that a spill of phthalate esters from a parked tanker truck at the Ritter Trucking Company occurred in July 1985. It was reported the spill flowed down an embankment to an adjacent property. Surface water and sediment samples were tested for VOCs, SVOCs, pesticides, PCBs, cyanide, and metals as part of a Site Inspection Prioritization of the Ritter Trucking Company property. The surface water and sediment sample locations are shown on Figure 1. Results indicated that an industrial property (Ritter Trucking) upstream of the North Pond likely contributed bis (2-ethylhexyl)phthalate (BEHP) and other constituents to the pond surface water and sediment. The reference sediment sample (SD-08), collected in the surface drainage feature to the northeast of the Ritter Trucking property, also contained BEHP at 23,000 µg/kg, indicating another off-site source to the northeast of Ritter Trucking. The report concluded that substances "detected in sediment samples (and that are partially attributable to the RTC property) included acetone, anthracene, bis (2-ethylhexyl) phthalate, cadmium, copper, di-n-octyl phthalate, lead, pyrene, and toluene."
- Confirm groundwater flow direction and groundwater discharge in the area from the South/East Ditch confluence to North Pond – Groundwater from the Olin property flows

generally southeast in the direction of the North Pond. MassDEP (MCP) sites north of the North Pond have groundwater flow directions that are generally towards the south or southeast, towards North Pond.

- Issue an Interim report for the Part I investigations, including a SOW for proposed field investigations.

MACTEC, 2004. North Pond Investigation Part II. February 19.

Additional investigations were proposed following the work that was completed in the North Pond study area during 2002. In November 2003, three soil borings were advanced within the North Pond study area in the approximate location of the inlet of the reported ditch to North Pond (near the intersection of Woburn Street and Presidential Way). The locations of these borings (NPSB1 through NPSB3) are shown in Figure 1. In two of the soil borings, three soil layers were encountered and sampled—fill, urban fill, and historical sediment/underlying soils. One boring could not be advanced beyond fill material. Current aquatic sediment was also sampled within the North Pond. Historical sediment samples collected from the soil borings were submitted for Electron Microscope Analysis and Cesium 137 dating. (Historical sediment samples collected from locations NPSB1 and NPSB3.) The soil and historical sediment samples were analyzed for VOCs (including trimethylpentenes), SVOCs, pesticides, herbicides, ammonia nitrogen, pH, chloride, sulfate, NDMA, mercury, cyanide, hexavalent chromium, and antimony, total chromium, arsenic, lead, and thallium. The analytical data for these soil samples and for the current aquatic sediment sample are presented in Table 1 and Table 2 respectively.

Groundwater samples were collected from five monitoring wells within and adjacent to the former limits of North Pond (GW-74S, GW-74D, GW-80S, GW-80D, and GW-80BR). Samples were analyzed for pH, bicarbonate and carbonate alkalinity, specific conductance, chloride, sulfate, ammonia nitrogen, trimethylpentenes, bis-(2-ethylhexyl) phthalate, NDMA, and dissolved calcium, chromium, iron, magnesium, manganese, potassium, and sodium. These sample locations are shown on Figure 1.

No detectable concentrations of trimethylpentenes, bis(2-ethylhexyl)phthalate (BEHP), N-nitrosodiphenylamine (NDPA), or N-nitrosodimethylamine (NDMA) were reported in the two samples identified as buried "historical sediment" samples (NPSB1-SED1 (collected from 6 – 7.5 ft bgs) and NPSB3-SED1 (collected from 9.4 – 10.4 ft bgs). The boring log forNPSB1-SED1 indicates the soil was mostly fine sand, with less than 20% brown to black silt, and 5-10% organic root fibers. For NPSB3-SED1, the boring log indicates mostly fine sand and silt, 10 – 15

% medium to coarse sand, and 15 – 20% silt. It appears these samples represent what visually was the closest thing to "historical sediments" within those borings. The descriptions are not consistent with a layer of muck referred to in the Superseding Order of Conditions or a layer of organic aquatic sediment. Based on the Cesium 137 dating, the historical sediment is either post-1964 or pre-1958. Additionally, reported concentrations of arsenic, chromium, lead, trivalent chromium, and nitrogen-ammonia are significantly below MCP Method 1 S-1/GW-1 and MCP Method 2 direct contact standards.

There were no detectable concentrations of trimethylpentenes, dissolved chromium or NDPA within the groundwater samples collected for this study. BEHP was detected in one sample collected at GW-74S, but not detected in the groundwater samples collected from monitoring wells between the property boundary and GW-74S. NDMA was detected at GW-80BR and GW-80D at concentrations below any aquatic life protection screening values. No detectable concentrations of NDMA were reported from the two shallow wells and the deep well located within the former limits of the North Pond; these results further support the conclusion that Olin site-related constituents do not extend to the monitoring wells GW-74S and GW-74D. MassDEP concurred with this conclusion for groundwater.

Based on the sampling results, the report concluded that there is no basis for concluding that historical releases from the Olin property contributed to, or resulted in, a release of hazardous material or oil in the North Pond study area.

<u>MACTEC, 2005. North Pond Investigation Part II Addendum. January 18.</u>

This investigation was conducted in response to MassDEP comments received on July 20, 2004. The purpose of the investigation was to confirm the subsurface conditions in the location where the reported ditch had previously intersected the North Pond. To address comments regarding the refusal of boring NBSB-2, two additional borings were completed and samples collected for analysis. The additional borings were designated as NPSB-4 and NPSB-4-2. These borings were advanced approximately 25-30 feet south of the previous boring SNPSB-2 (which had met refusal). Soil samples were collected from the buried sediment and underlying native soil horizons from boring NPSB-4 (minimal amounts of material recovered for samples) and the upper fill and buried sediment horizons from boring NPSB-4-2 (most of the sample material recovered from this boring).

Results from the historical sediment sample revealed no detectable concentrations of VOCs (including trimethylpentenes), SVOCs (including BEHP and NDMA), herbicides, or hexavalent chromium. Arsenic, total chromium, lead, nitrogen-ammonia, chloride, and sulfate were detected. The overall cesium 137 analysis results suggest the age of the sediment is either pre-1958 or post-1964. However, two samples submitted for cesium 137 analysis had detectable concentrations of cesium 137, suggesting that some of the sediment could be from the 1958 to 1964 time period. These two detections were at the lowest measurable level and were from non-contiguous samples supporting the notion that material from the identified sediment layer in the North Pond borings has been disrupted and precludes the possibility of establishing a reliable depositional chronology by cesium 137 analysis.

The soil samples collected from the overlying fill material and the underlying native soils were analyzed for the same suite of chemicals as conducted on the historical sediment samples. Overlying fill material contained detectable concentrations of toluene, BEHP, arsenic, total chromium, lead, chloride, ammonia-nitrogen, and sulfate. The overlying fill material was brought in by a third party and is not related to the Olin property. The underlying native soils contained no detectable concentrations of VOCs or SVOCs. There were detected concentrations of DDT, arsenic, total chromium, lead, chloride, ammonia-nitrogen, and sulfate, but the concentrations were not indicative of a release related to the Olin property.

This investigation concluded that there continues to be no empirical basis for concluding that releases at the Olin Site contributed to, or resulted in, a release of hazardous material or oil in the North Pond Study Area. No detectable concentrations of key Site related constituents, including trimethylpentenes, BEHP, NDPA, or NDMA, were reported in historical sediment. Furthermore, the reported concentrations in historical sediment of arsenic, lead, trivalent chromium and nitrogen-ammonia are significantly below the applicable screening values, which included the MCP Method 1 S-1/GW-1 and MCP Method 2 direct contact standards.

2.0 PROPOSED INVESTIGATION

Six soil borings will be advanced at locations identified in Figure 1 using a rotosonic rig to characterize the subsurface conditions in the portion of the North Pond that is in close proximity to the historical inlet area of the un-named ditch on the western edge of the North Pond. These six borings will be advanced within the historical boundaries of North Pond. Borings will be advanced to 20 feet or refusal. Soils will be logged and will be visually inspected to identify an

organic layer that may represent historical North Pond sediments. If an organic layer is observed that may represent historical North Pond sediments, a sample will be collected. Samples will be submitted for laboratory analysis of the standard comprehensive analyte list.

Existing surficial sediments of the North Pond would not be representative of impacts associated with potential surface water flows that might have occurred between 1953 and 1972 (between 37 and 56 years ago). Approximately 73% of the 1955 footprint of North Pond has been reworked and filled. The 1984 Superseding Order of Conditions also called for dredging of the southern portion of the North Pond (the current open water area between the dike at the southern edge of the pond and the peninsulas that were created in the pond) to elevation 62 feet so that the water depth would be eight feet. This would suggest that 1984 surficial sediments (and sediments from the 1953 – 1972 time frame) in the current open water portion of the pond would have been excavated and removed from the pond. The order did not allow re-use of dredged material as fill for the pond. Only a very small fraction (if any) of sediments from the 1953 – 1972 time period would be likely to remain in the North Pond. Since current pond sediments are highly unlikely to reflect any impacts associated with activities that potentially occurred 37 to 56 years ago. There is no evidence that there is any existing physical connection between the Olin Chemical Superfund Site and the North Pond. Therefore, no surficial sediment samples are proposed for the North Pond.

The North Pond investigation will be conducted to evaluate potential impacts on buried historical sediments in the pond. If they are determined to be present, the buried historical sediments would not be accessible by any human receptors and they would not be within the biologically active zone (0 – 6 inches from the surface) as defined by USEPA that would be evaluated in the ecological risk assessment. Therefore, it appears that there would be no complete exposure pathways associated with the North Pond historical sediments if remnants are present. The results of the investigation will be reviewed, and only if it is determined that there is a complete exposure pathway, would the North Pond area be incorporated into the Baseline Human Health Risk Assessment and/or the Baseline Ecological Risk Assessment.

TABLES

Table 1. Soil Analytical Data
Addendum I - North Pond Investigation
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Non Detects	Range of Detected Concentrations	Average of All Samples	NPSB1-Fill1 NPSB1 11/20/2003 0-2	NPSB1-SED1 NPSB1 11/20/2003 6-7_5	NPSB1-SOIL1 NPSB1 11/20/2003 9-11	NPSB2-Fill1 NPSB2 11/20/2003 2-3	NPSB3-Fill1 NPSB3 11/20/2003 2-4	NPSB3-SED1 NPSB3 11/20/2003 9_4-10_4
Volatile Organics (mg/kg)										
1,1,1,2-Tetrachloroethane	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
1,1,1-Trichloroethane	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
1,1,2,2-Tetrachloroethane	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
1,1,2-Trichloroethane	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
1,1-Dichloroethane	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
1,1-Dichloroethene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
1,1-Dichloropropene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
1,2,3-Trichlorobenzene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
1,2,3-Trichloropropane	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
1,2,4-Trichlorobenzene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
1,2,4-Trimethylbenzene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
1,2-Dibromo-3-chloropropane	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
1,2-Dibromoethane	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
1,2-Dichlorobenzene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
1,2-Dichloroethane	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
1,2-Dichloropropane	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
1,3,5-Trimethylbenzene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
1,3-Dichlorobenzene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
1,3-Dichloropropane	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
1,4-Dichlorobenzene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
1,4-Dioxane	0 / 7	0.17 - 11		0.892857		0.3 U	0.29 U			0.27 U
2,2-Dichloropropane	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
2,4,4-Trimethyl-1-pentene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
2,4,4-Trimethyl-2-Pentene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
2-Butanone	0 / 7	0.014 - 0.85		0.069357		0.024 U	0.023 U			0.022 U
2-Chloroethyl vinyl ether	0 / 4	0.003 - 0.003		0.0015		0.003 U	0.003 U			0.003 U
2-Chlorotoluene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
2-Hexanone	0 / 7	0.014 - 0.85		0.069357		0.024 U	0.023 U			0.022 U
4-Chlorotoluene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
4-iso-Propyltoluene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
4-Methyl-2-pentanone	0 / 7	0.014 - 0.85		0.069357		0.024 U	0.023 U			0.022 U
Acetone	0 / 7	0.034 - 2.1		0.171643		0.061 U	0.058 U			0.055 U
Benzene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Bromobenzene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Bromochloromethane	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Bromodichloromethane	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Bromoform	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Bromomethane	0 / 7	0.0034 - 0.21		0.0171		0.006 U	0.006 U			0.005 U
Butane, 2-methoxy-2-methyl-	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Carbon disulfide	0 / 7	0.034 - 2.1		0.171643		0.061 U	0.058 U			0.055 U

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Carbon tetrachloride	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Chlorobenzene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Chlorodibromomethane	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Chloroethane	0 / 7	0.0034 - 0.21		0.0171		0.006 U	0.006 U			0.005 U
Chloroform	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Chloromethane	0 / 7	0.0034 - 0.21		0.0171		0.006 U	0.006 U			0.005 U
Cis-1,2-Dichloroethene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
cis-1,3-Dichloropropene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Dibromomethane	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Dichlorodifluoromethane	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Diethyl ether	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Diisopropylether	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Ethyl benzene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Ethyl-t-Butyl Ether	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Hexachlorobutadiene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Isopropylbenzene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Methyl Tertbutyl Ether	0 / 7	0.0034 - 0.21		0.0171		0.006 U	0.006 U			0.005 U
Methylene chloride	0 / 7	0.0034 - 0.21		0.0171		0.006 U	0.006 U			0.005 U
Naphthalene	0 / 7	0.017 - 1.1		0.089286		0.03 U	0.029 U			0.027 U
n-Butylbenzene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Propylbenzene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
sec-Butylbenzene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Styrene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
tert-Butylbenzene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Tetrachloroethene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Tetrahydrofuran	0 / 7	0.0034 - 0.21		0.0171		0.006 U	0.006 U			0.005 U
Toluene	1 / 7	0.0017 - 0.11	0.0042 - 0.0042	0.009436		0.003 U	0.003 U			0.003 U
trans-1,2-Dichloroethene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
trans-1,3-Dichloropropene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Trichloroethene	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Trichlorofluoromethane	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Vinyl acetate	0 / 7	0.0068 - 0.42		0.034336		0.012 U	0.012 U			0.011 U
Vinyl chloride	0 / 7	0.0034 - 0.21		0.0171		0.006 U	0.006 U			0.005 U
Xylene, m/p	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Xylene, o	0 / 7	0.0017 - 0.11		0.008979		0.003 U	0.003 U			0.003 U
Semivolatile Organics (mg/kg)										
1,2,4-Trichlorobenzene	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
1,2-Dichlorobenzene	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
1,3-Dichlorobenzene	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
1,4-Dichlorobenzene	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
2,2'-Dichlorodiisopropylether	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U

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2,4,5-Trichlorophenol	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
2,4,6-Trichlorophenol	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
2,4-Dichlorophenol	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
2,4-Dimethylphenol	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
2,4-Dinitrophenol	0 / 5	0.4 - 2.4		0.89		2.2 UJ				0.4 U
2,4-Dinitrotoluene	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
2,6-Dinitrotoluene	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
2-Chloronaphthalene	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
2-Chlorophenol	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
2-Methylnaphthalene	0 / 5	0.4 - 2.2		0.574		2.2 U				0.4 U
2-Methylphenol	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
2-Nitroaniline	0 / 5	2 - 12		4.44		11 U				2 U
2-Nitrophenol	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
3,3'-Dichlorobenzidine	0 / 5	0.79 - 4.8		1.759		4.3 U				0.79 U
3-Nitroaniline	0 / 5	2 - 12		4.44		11 U				2 U
4,6-Dinitro-2-methylphenol	0 / 5	2 - 12		4.44		11 U				2 U
4-Bromophenyl phenyl ether	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
4-Chloro-3-methylphenol	0 / 5	0.79 - 4.8		1.759		4.3 U				0.79 U
4-Chloroaniline	0 / 5	0.79 - 4.8		1.759		4.3 U				0.79 U
4-Chlorophenyl phenyl ether	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
4-Nitroaniline	0 / 5	2 - 12		4.44		11 U				2 U
4-Nitrophenol	0 / 5	2 - 12		4.44		11 U				2 U
Acenaphthene	0 / 5	0.4 - 2.2		0.574		2.2 U				0.4 U
Acenaphthylene	0 / 5	0.4 - 2.2		0.574		2.2 U				0.4 U
Acetophenone	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
Aniline	0 / 5	2 - 12		4.44		11 U				2 U
Anthracene	0 / 5	0.4 - 2.2		0.574		2.2 U				0.4 U
Azobenzene	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
Benzo(a)anthracene	0 / 5	0.4 - 2.2		0.574		2.2 U				0.4 U
Benzo(a)pyrene	0 / 5	0.4 - 2.2		0.574		2.2 U				0.4 U
Benzo(b)fluoranthene	0 / 5	0.4 - 2.2		0.574		2.2 U				0.4 U
Benzo(ghi)perylene	0 / 5	0.4 - 2.2		0.574		2.2 U				0.4 U
Benzo(k)fluoranthene	0 / 5	0.4 - 2.2		0.574		2.2 U				0.4 U
Benzoic Acid	0 / 5	2 - 12		4.44		11 UJ				2 U
Benzyl alcohol	0 / 5	0.79 - 4.8		1.759		4.3 U				0.79 U
Bis(2-Chloroethoxy)methane	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
Bis(2-Chloroethyl)ether	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
Bis(2-Ethylhexyl)phthalate	1 / 5	0.4 - 2.4	0.73 - 0.73	0.836		2.2 U				0.4 U
Butylbenzylphthalate	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
Chrysene	0 / 5	0.4 - 2.2		0.574		2.2 U				0.4 U
Dibenz(a,h)anthracene	0 / 5	0.4 - 2.2		0.574		2.2 U				0.4 U

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Dibenzofuran	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
Diethylphthalate	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
Dimethylphthalate	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
Di-n-butylphthalate	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
Di-n-octylphthalate	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
Fluoranthene	0 / 5	0.4 - 2.2		0.574		2.2 U				0.4 U
Fluorene	0 / 5	0.4 - 2.2		0.574		2.2 U				0.4 U
Hexachlorobenzene	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
Hexachlorobutadiene	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
Hexachlorocyclopentadiene	0 / 4	0.4 - 2.4		0.8375		R				0.4 UJ
Hexachloroethane	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
Indeno(1,2,3-cd)pyrene	0 / 5	0.4 - 2.2		0.574		2.2 U				0.4 U
Isophorone	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
m+p-Methylphenol	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
Naphthalene	0 / 5	0.4 - 2.2		0.574		2.2 U				0.4 U
Nitrobenzene	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
N-Nitrosodimethylamine	0 / 5	0.0058 - 0.009		0.0035		0.007 U				0.006 U
N-Nitrosodi-n-propylamine	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
N-Nitrosodiphenylamine	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
Pentachlorophenol	0 / 5	2 - 12		4.44		11 U				2 U
Phenanthrene	0 / 5	0.4 - 2.2		0.574		2.2 U				0.4 U
Phenol	0 / 5	0.4 - 2.4		0.89		2.2 U				0.4 U
Pyrene	0 / 5	0.4 - 2.2		0.574		2.2 U				0.4 U
Pesticides (mg/kg)										
4,4'-DDD	0 / 5	0.011 - 0.014		0.0062		0.013 U				0.012 U
4,4'-DDE	0 / 5	0.011 - 0.014		0.0062		0.013 U				0.012 U
4,4'-DDT	2 / 5	0.011 - 0.013	0.027 - 0.047	0.0184		0.013 U				0.012 U
Aldrin	0 / 5	0.011 - 0.014		0.0062		0.013 U				0.012 U
Alpha-BHC	0 / 5	0.011 - 0.014		0.0062		0.013 U				0.012 U
Beta-BHC	0 / 5	0.011 - 0.014		0.0062		0.013 U				0.012 U
Chlordane	0 / 5	0.057 - 0.07		0.0306		0.063 U				0.058 U
Delta-BHC	0 / 5	0.011 - 0.014		0.0062		0.013 U				0.012 U
Dieldrin	0 / 5	0.011 - 0.014		0.0062		0.013 U				0.012 U
Endosulfan I	0 / 5	0.011 - 0.014		0.0062		0.013 U				0.012 U
Endosulfan II	0 / 5	0.011 - 0.014		0.0062		0.013 UJ				0.012 U
Endosulfan sulfate	0 / 5	0.011 - 0.014		0.0062		0.013 UJ				0.012 U
Endrin	0 / 5	0.011 - 0.014		0.0062		0.013 U				0.012 U
Endrin aldehyde	0 / 3	0.011 - 0.014		0.006167						
Endrin ketone	0 / 5	0.011 - 0.014		0.0062		0.013 U				0.012 U
Gamma-BHC/Lindane	0 / 5	0.011 - 0.014		0.0062		0.013 U				0.012 U
Heptachlor	0 / 5	0.011 - 0.014		0.0062		0.013 U				0.012 U

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Heptachlor epoxide	0 / 5	0.011 - 0.014		0.0062		0.013 U				0.012 U
Hexachlorobenzene	0 / 5	0.011 - 0.014		0.0062		0.013 U				0.012 U
Methoxychlor	0 / 5	0.023 - 0.028		0.0122		0.025 U				0.023 U
Toxaphene	0 / 3	0.57 - 0.7		0.308333						
Herbicides (mg/kg)										
2,4,5-T	0 / 4	0.000601 - 0.0067		0.002588		0.000601 U				
2,4,5-TP/Silvex	0 / 4	0.000601 - 0.0067		0.002588		0.000601 U				
2,4-D	0 / 4	0.000601 - 0.0067		0.002588		0.000601 U				
2,4-DB	0 / 4	0.000601 - 0.0067		0.002588		0.000601 U				
BUTYRIC ACID, 4-((4-CHLORO-O-TOLYL)OXY)-	0 / 4	0.00601 - 0.67		0.252001		0.00601 U				
Dalapon	0 / 4	0.000601 - 0.0067		0.002588		0.000601 U				
Dicamba	0 / 4	0.000601 - 0.0067		0.002588		0.000601 U				
Dichloroprop	0 / 4	0.000601 - 0.0067		0.002588		0.000601 U				
Dinoseb	0 / 4	0.000601 - 0.0067		0.002588		0.000601 U				
MCPA	0 / 4	0.00601 - 0.67		0.252001		0.00601 U				
MCPP	0 / 4	0.00601 - 0.67		0.252001		0.00601 U				
Metals (mg/kg)										
Antimony	0 / 8	0.595 - 1.7		0.550563	1.19 U	0.696 U		0.595 U	1.3 U	0.628 U
Arsenic	8 / 8		1.22 - 60	11.6875	60	4.72		7.97	3.29	1.22
Chromium	8 / 8		15.5 - 53.8	33.4	18.8	17.5		50.6	53.8	15.5
Chromium, Hexavalent	0 / 8	0.54 - 5.6		1.144375	0.54 U	0.66 U		0.57 U	0.54 U	0.6 U
Chromium, Trivalent	5 / 5		15.5 - 53.8	31.26	18.8	17.6		50.6	53.8	15.5
Lead	8 / 8		2.76 - 18.4	9.45	5.82	5.18		18.4	6.24	2.76
Mercury	1 / 8	0.049 - 0.13	0.052 - 0.052	0.040313	0.049 U	0.06 U		0.052	0.05 U	0.052 U
Thallium	2 / 8	0.628 - 1.7	0.944 - 3.48	0.985125	1.19 U	0.696 U		0.944	3.48	0.628 U
Inorganics (mg/kg)										
Chloride	7 / 7		6.4 - 70.8	29.54286		70.8	15.2			39.1
Cyanide, Total	0 / 10	0.8 - 1		0.471	0.99 U	0.97 U	1 U	0.92 U	1 U	0.92 U
Nitrogen, as Ammonia	7 / 7		4.5 - 55.8	26.6		55.8	4.5			13
Sulfate	7 / 7		5.6 - 96	30.12857		15.5	25.5			6.3
Percent Solids	10 / 10		69.5 - 92.8	83.61	92.8	76.2	80.9	88.2	92	83.2
pH	4 / 4		6.5 - 7.37	6.7425		6.5	6.57			7.37

Table 1. Soil Analytical Data
Addendum I - North Pond Investigation
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	NPSB3-SOIL1 NPSB3 11/20/2003 10_4-12	NPSB4-Fill NPSB4 9/8/2004 0-2	NPSB4-Sed NPSB4 9/8/2004 5-7	NPSB4-Soil NPSB4 9/8/2004 10-11_5
Volatile Organics (mg/kg)				
1,1,1,2-Tetrachloroethane	0.003 U	0.002 U	0.0017 U	0.11 U
1,1,1-Trichloroethane	0.003 U	0.002 U	0.0017 U	0.11 U
1,1,2,2-Tetrachloroethane	0.003 U	0.002 U	0.0017 U	0.11 U
1,1,2-Trichloroethane	0.003 U	0.002 U	0.0017 U	0.11 U
1,1-Dichloroethane	0.003 U	0.002 U	0.0017 U	0.11 U
1,1-Dichloroethene	0.003 U	0.002 U	0.0017 U	0.11 U
1,1-Dichloropropene	0.003 U	0.002 U	0.0017 U	0.11 U
1,2,3-Trichlorobenzene	0.003 U	0.002 U	0.0017 U	0.11 U
1,2,3-Trichloropropane	0.003 U	0.002 U	0.0017 U	0.11 U
1,2,4-Trichlorobenzene	0.003 U	0.002 U	0.0017 U	0.11 U
1,2,4-Trimethylbenzene	0.003 U	0.002 U	0.0017 U	0.11 U
1,2-Dibromo-3-chloropropane	0.003 U	0.002 U	0.0017 U	0.11 U
1,2-Dibromoethane	0.003 U	0.002 U	0.0017 U	0.11 U
1,2-Dichlorobenzene	0.003 U	0.002 U	0.0017 U	0.11 U
1,2-Dichloroethane	0.003 U	0.002 U	0.0017 U	0.11 U
1,2-Dichloropropane	0.003 U	0.002 U	0.0017 U	0.11 U
1,3,5-Trimethylbenzene	0.003 U	0.002 U	0.0017 U	0.11 U
1,3-Dichlorobenzene	0.003 U	0.002 U	0.0017 U	0.11 U
1,3-Dichloropropane	0.003 U	0.002 U	0.0017 U	0.11 U
1,4-Dichlorobenzene	0.003 U	0.002 U	0.0017 U	0.11 U
1,4-Dioxane	0.27 U	0.2 U	0.17 U	11 U
2,2-Dichloropropane	0.003 U	0.002 UJ	0.0017 UJ	0.11 UJ
2,4,4-Trimethyl-1-pentene	0.003 U	0.002 U	0.0017 U	0.11 U
2,4,4-Trimethyl-2-Pentene	0.003 U	0.002 U	0.0017 U	0.11 U
2-Butanone	0.022 U	0.016 U	0.014 U	0.85 U
2-Chloroethyl vinyl ether	0.003 U	R	R	R
2-Chlorotoluene	0.003 U	0.002 U	0.0017 U	0.11 U
2-Hexanone	0.022 U	0.016 U	0.014 U	0.85 U
4-Chlorotoluene	0.003 U	0.002 U	0.0017 U	0.11 U
4-iso-Propyltoluene	0.003 U	0.002 U	0.0017 U	0.11 U
4-Methyl-2-pentanone	0.022 U	0.016 U	0.014 U	0.85 U
Acetone	0.055 U	0.04 U	0.034 U	2.1 U
Benzene	0.003 U	0.002 U	0.0017 U	0.11 U
Bromobenzene	0.003 U	0.002 U	0.0017 U	0.11 U
Bromochloromethane	0.003 U	0.002 U	0.0017 U	0.11 U
Bromodichloromethane	0.003 U	0.002 U	0.0017 U	0.11 U
Bromoform	0.003 U	0.002 U	0.0017 U	0.11 U
Bromomethane	0.005 U	0.004 U	0.0034 U	0.21 U
Butane, 2-methoxy-2-methyl-	0.003 U	0.002 U	0.0017 U	0.11 U
Carbon disulfide	0.055 U	0.04 U	0.034 U	2.1 U

Table 1. Soil Analytical Data
Addendum I - North Pond Investigation
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	NPSB3-SOIL1 NPSB3 11/20/2003 10_4-12	NPSB4-Fill NPSB4 9/8/2004 0-2	NPSB4-Sed NPSB4 9/8/2004 5-7	NPSB4-Soil NPSB4 9/8/2004 10-11_5
Carbon tetrachloride	0.003 U	0.002 UJ	0.0017 UJ	0.11 UJ
Chlorobenzene	0.003 U	0.002 U	0.0017 U	0.11 U
Chlorodibromomethane	0.003 U	0.002 U	0.0017 U	0.11 U
Chloroethane	0.005 U	0.004 U	0.0034 U	0.21 U
Chloroform	0.003 U	0.002 U	0.0017 U	0.11 U
Chloromethane	0.005 U	0.004 U	0.0034 U	0.21 U
Cis-1,2-Dichloroethene	0.003 U	0.002 U	0.0017 U	0.11 U
cis-1,3-Dichloropropene	0.003 U	0.002 U	0.0017 U	0.11 U
Dibromomethane	0.003 U	0.002 U	0.0017 U	0.11 U
Dichlorodifluoromethane	0.003 U	0.002 U	0.0017 U	0.11 U
Diethyl ether	0.003 U	0.002 U	0.0017 U	0.11 U
Diisopropylether	0.003 U	0.002 U	0.0017 U	0.11 U
Ethyl benzene	0.003 U	0.002 U	0.0017 U	0.11 U
Ethyl-t-Butyl Ether	0.003 U	0.002 U	0.0017 U	0.11 U
Hexachlorobutadiene	0.003 U	0.002 U	0.0017 U	0.11 U
Isopropylbenzene	0.003 U	0.002 U	0.0017 U	0.11 U
Methyl Tertbutyl Ether	0.005 U	0.004 U	0.0034 U	0.21 U
Methylene chloride	0.005 U	0.004 U	0.0034 U	0.21 U
Naphthalene	0.027 U	0.02 U	0.017 U	1.1 U
n-Butylbenzene	0.003 U	0.002 U	0.0017 U	0.11 U
Propylbenzene	0.003 U	0.002 U	0.0017 U	0.11 U
sec-Butylbenzene	0.003 U	0.002 U	0.0017 U	0.11 U
Styrene	0.003 U	0.002 U	0.0017 U	0.11 U
tert-Butylbenzene	0.003 U	0.002 U	0.0017 U	0.11 U
Tetrachloroethene	0.003 U	0.002 U	0.0017 U	0.11 U
Tetrahydrofuran	0.005 U	0.004 U	0.0034 U	0.21 U
Toluene	0.003 U	0.0042	0.0017 U	0.11 U
trans-1,2-Dichloroethene	0.003 U	0.002 U	0.0017 U	0.11 U
trans-1,3-Dichloropropene	0.003 U	0.002 U	0.0017 U	0.11 U
Trichloroethene	0.003 U	0.002 U	0.0017 U	0.11 U
Trichlorofluoromethane	0.003 U	0.002 U	0.0017 U	0.11 U
Vinyl acetate	0.011 U	0.0079 U	0.0068 U	0.42 U
Vinyl chloride	0.005 U	0.004 U	0.0034 U	0.21 U
Xylene, m/p	0.003 U	0.002 U	0.0017 U	0.11 U
Xylene, o	0.003 U	0.002 U	0.0017 U	0.11 U
Semivolatile Organics (mg/kg)				
1,2,4-Trichlorobenzene		2 U	2.4 U	1.9 U
1,2-Dichlorobenzene		2 U	2.4 U	1.9 U
1,3-Dichlorobenzene		2 U	2.4 U	1.9 U
1,4-Dichlorobenzene		2 U	2.4 U	1.9 U
2,2'-Dichlorodiisopropylether		2 U	2.4 U	1.9 U

U = not detected, number shown is the reporting limit

Table 1. Soil Analytical Data
Addendum I - North Pond Investigation
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	NPSB3-SOIL1 NPSB3 11/20/2003 10_4-12	NPSB4-Fill NPSB4 9/8/2004 0-2	NPSB4-Sed NPSB4 9/8/2004 5-7	NPSB4-Soil NPSB4 9/8/2004 10-11_5
2,4,5-Trichlorophenol		2 U	2.4 U	1.9 U
2,4,6-Trichlorophenol		2 U	2.4 U	1.9 U
2,4-Dichlorophenol		2 U	2.4 U	1.9 U
2,4-Dimethylphenol		2 U	2.4 U	1.9 U
2,4-Dinitrophenol		2 U	2.4 U	1.9 U
2,4-Dinitrotoluene		2 U	2.4 U	1.9 U
2,6-Dinitrotoluene		2 U	2.4 U	1.9 U
2-Chloronaphthalene		2 U	2.4 U	1.9 U
2-Chlorophenol		2 U	2.4 U	1.9 U
2-Methylnaphthalene		0.99 U	1.2 U	0.95 U
2-Methylphenol		2 U	2.4 U	1.9 U
2-Nitroaniline		9.9 U	12 U	9.5 U
2-Nitrophenol		2 U	2.4 U	1.9 U
3,3`-Dichlorobenzidine		3.9 U	4.8 U	3.8 U
3-Nitroaniline		9.9 U	12 U	9.5 U
4,6-Dinitro-2-methylphenol		9.9 U	12 U	9.5 U
4-Bromophenyl phenyl ether		2 U	2.4 U	1.9 U
4-Chloro-3-methylphenol		3.9 U	4.8 U	3.8 U
4-Chloroaniline		3.9 U	4.8 U	3.8 U
4-Chlorophenyl phenyl ether		2 U	2.4 U	1.9 U
4-Nitroaniline		9.9 U	12 U	9.5 U
4-Nitrophenol		9.9 U	12 U	9.5 U
Acenaphthene		0.99 U	1.2 U	0.95 U
Acenaphthylene		0.99 U	1.2 U	0.95 U
Acetophenone		2 U	2.4 U	1.9 U
Aniline		9.9 U	12 U	9.5 U
Anthracene		0.99 U	1.2 U	0.95 U
Azobenzene		2 U	2.4 U	1.9 U
Benzo(a)anthracene		0.99 U	1.2 U	0.95 U
Benzo(a)pyrene		0.99 U	1.2 U	0.95 U
Benzo(b)fluoranthene		0.99 U	1.2 U	0.95 U
Benzo(ghi)perylene		0.99 U	1.2 U	0.95 U
Benzo(k)fluoranthene		0.99 U	1.2 U	0.95 U
Benzoic Acid		9.9 U	12 U	9.5 U
Benzyl alcohol		3.9 U	4.8 U	3.8 U
Bis(2-Chloroethoxy)methane		2 U	2.4 U	1.9 U
Bis(2-Chloroethyl)ether		2 U	2.4 U	1.9 U
Bis(2-Ethylhexyl)phthalate		0.73 J	2.4 U	1.9 U
Butylbenzylphthalate		2 U	2.4 U	1.9 U
Chrysene		0.99 U	1.2 U	0.95 U
Dibenz(a,h)anthracene		0.99 U	1.2 U	0.95 U

Table 1. Soil Analytical Data
Addendum I - North Pond Investigation
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	NPSB3-SOIL1 NPSB3 11/20/2003 10_4-12	NPSB4-Fill NPSB4 9/8/2004 0-2	NPSB4-Sed NPSB4 9/8/2004 5-7	NPSB4-Soil NPSB4 9/8/2004 10-11_5
Dibenzofuran		2 U	2.4 U	1.9 U
Diethylphthalate		2 U	2.4 U	1.9 U
Dimethylphthalate		2 U	2.4 U	1.9 U
Di-n-butylphthalate		2 U	2.4 U	1.9 U
Di-n-octylphthalate		2 U	2.4 U	1.9 U
Fluoranthene		0.99 U	1.2 U	0.95 U
Fluorene		0.99 U	1.2 U	0.95 U
Hexachlorobenzene		2 U	2.4 U	1.9 U
Hexachlorobutadiene		2 U	2.4 U	1.9 U
Hexachlorocyclopentadiene		2 U	2.4 U	1.9 U
Hexachloroethane		2 U	2.4 U	1.9 U
Indeno(1,2,3-cd)pyrene		0.99 U	1.2 U	0.95 U
Isophorone		2 U	2.4 U	1.9 U
m+p-Methylphenol		2 U	2.4 U	1.9 U
Naphthalene		0.99 U	1.2 U	0.95 U
Nitrobenzene		2 U	2.4 U	1.9 U
N-Nitrosodimethylamine		0.009 U	0.0072 U	0.0058 U
N-Nitrosodi-n-propylamine		2 U	2.4 U	1.9 U
N-Nitrosodiphenylamine		2 U	2.4 U	1.9 U
Pentachlorophenol		9.9 U	12 U	9.5 U
Phenanthrene		0.99 U	1.2 U	0.95 U
Phenol		2 U	2.4 U	1.9 U
Pyrene		0.99 U	1.2 U	0.95 U
Pesticides (mg/kg)				
4,4`-DDD		0.011 U	0.014 U	0.012 U
4,4`-DDE		0.011 U	0.014 U	0.012 U
4,4`-DDT		0.011 U	0.047	0.027
Aldrin		0.011 U	0.014 U	0.012 U
Alpha-BHC		0.011 U	0.014 U	0.012 U
Beta-BHC		0.011 U	0.014 U	0.012 U
Chlordane		0.057 U	0.07 U	0.058 U
Delta-BHC		0.011 U	0.014 U	0.012 U
Dieldrin		0.011 U	0.014 U	0.012 U
Endosulfan I		0.011 U	0.014 U	0.012 U
Endosulfan II		0.011 U	0.014 U	0.012 U
Endosulfan sulfate		0.011 U	0.014 U	0.012 U
Endrin		0.011 U	0.014 U	0.012 U
Endrin aldehyde		0.011 U	0.014 U	0.012 U
Endrin ketone		0.011 U	0.014 U	0.012 U
Gamma-BHC/Lindane		0.011 U	0.014 U	0.012 U
Heptachlor		0.011 U	0.014 U	0.012 U

Table 1. Soil Analytical Data
Addendum I - North Pond Investigation
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	NPSB3-SOIL1 NPSB3 11/20/2003 10_4-12	NPSB4-Fill NPSB4 9/8/2004 0-2	NPSB4-Sed NPSB4 9/8/2004 5-7	NPSB4-Soil NPSB4 9/8/2004 10-11_5
Heptachlor epoxide		0.011 U	0.014 U	0.012 U
Hexachlorobenzene		0.011 U	0.014 U	0.012 U
Methoxychlor		0.023 U	0.028 U	0.023 U
Toxaphene		0.57 U	0.7 U	0.58 U
Herbicides (mg/kg)				
2,4,5-T		0.0067 U	0.0067 U	0.0067 U
2,4,5-TP/Silvex		0.0067 U	0.0067 U	0.0067 U
2,4-D		0.0067 U	0.0067 U	0.0067 U
2,4-DB		0.0067 U	0.0067 U	0.0067 U
BUTYRIC ACID, 4-((4-CHLORO-O-TOLYL)OXY)-		0.67 U	0.67 U	0.67 U
Dalapon		0.0067 U	0.0067 U	0.0067 U
Dicamba		0.0067 U	0.0067 U	0.0067 U
Dichloroprop		0.0067 U	0.0067 U	0.0067 U
Dinoseb		0.0067 U	0.0067 U	0.0067 U
MCPA		0.67 U	0.67 U	0.67 U
MCPP		0.67 U	0.67 U	0.67 U
Metals (mg/kg)				
Antimony		1.5 U	1.7 U	1.2 U
Arsenic		5.1	7.5	3.7
Chromium		50	32	29
Chromium, Hexavalent		5.6 UJ	4.9 UJ	4.9 UJ
Chromium, Trivalent				
Lead		12	17	8.2
Mercury		0.1 U	0.13 U	0.1 U
Thallium		1.5 U	1.7 U	1.2 U
Inorganics (mg/kg)				
Chloride	60.8	6.4	6.4	8.1
Cyanide, Total	0.82 U	1 U	1 U	0.8 U
Nitrogen, as Ammonia	5.9	43	43	21
Sulfate	5.6	12	96	50
Percent Solids	82.8	84.3	69.5	86.2
pH	6.53			

Prepared By:	MJM	8/13/2009
Checked By:	BJR	8/13/2009

Table 2. Sediment Analytical Data
Addendum I - North Pond Investigation
Olin Chemical Superfund Site
Wilmingtin, Massachusetts

Parameter	Frequency of Detection	Range of Non Detects	Range of Detected Concentrations	Average of All Samples	NPSED1 NPSED1-SED1 11/20/2003 0-1	NPSED1 NPSED1-SED1 DUP 11/20/2003 0-1
Volatile Organics (mg/kg)						
1,1,1,2-Tetrachloroethane	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
1,1,1-Trichloroethane	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
1,1,2,2-Tetrachloroethane	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
1,1,2-Trichloroethane	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
1,1-Dichloroethane	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
1,1-Dichloroethene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
1,1-Dichloropropene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
1,2,3-Trichlorobenzene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
1,2,3-Trichloropropane	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
1,2,4-Trichlorobenzene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
1,2,4-Trimethylbenzene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
1,2-Dibromo-3-chloropropane	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
1,2-Dibromoethane	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
1,2-Dichlorobenzene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
1,2-Dichloroethane	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
1,2-Dichloropropane	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
1,3,5-Trimethylbenzene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
1,3-Dichlorobenzene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
1,3-Dichloropropane	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
1,4-Dichlorobenzene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
1,4-Dioxane	0 / 2	0.5 - 0.5		0.25	0.5 U	0.5 U
2,2-Dichloropropane	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
2,4,4-Trimethyl-1-pentene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
2,4,4-Trimethyl-2-Pentene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
2-Butanone	0 / 2	0.04 - 0.04		0.02	0.04 U	0.04 U
2-Chloroethyl vinyl ether	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
2-Chlorotoluene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
2-Hexanone	0 / 2	0.04 - 0.04		0.02	0.04 U	0.04 U
4-Chlorotoluene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
4-iso-Propyltoluene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
4-Methyl-2-pentanone	0 / 2	0.04 - 0.04		0.02	0.04 U	0.04 U
Acetone	2 / 2		0.96 - 1.6	1.28	0.96 N	1.6 N
Benzene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Bromobenzene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Bromochloromethane	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Bromodichloromethane	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Bromoform	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Bromomethane	0 / 2	0.01 - 0.01		0.005	0.01 U	0.01 U
Butane, 2-methoxy-2-methyl-	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Carbon disulfide	0 / 2	0.1 - 0.1		0.05	0.1 U	0.1 U

Table 2. Sediment Analytical Data
Addendum I - North Pond Investigation
Olin Chemical Superfund Site
Wilmingtin, Massachusetts

Parameter	Frequency of Detection	Range of Non Detects	Range of Detected Concentrations	Average of All Samples	NPSED1 NPSED1-SED1 11/20/2003 0-1	NPSED1 NPSED1-SED1 DUP 11/20/2003 0-1
Carbon tetrachloride	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Chlorobenzene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Chlorodibromomethane	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Chloroethane	0 / 2	0.01 - 0.01		0.005	0.01 U	0.01 U
Chloroform	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Chloromethane	0 / 2	0.01 - 0.01		0.005	0.01 U	0.01 U
Cis-1,2-Dichloroethene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
cis-1,3-Dichloropropene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Dibromomethane	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Dichlorodifluoromethane	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Diethyl ether	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Diisopropylether	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Ethyl benzene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Ethyl-t-Butyl Ether	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Hexachlorobutadiene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Isopropylbenzene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Methyl Tertbutyl Ether	0 / 2	0.01 - 0.01		0.005	0.01 U	0.01 U
Methylene chloride	0 / 2	0.01 - 0.01		0.005	0.01 U	0.01 U
Naphthalene	0 / 2	0.05 - 0.05		0.025	0.05 U	0.05 U
n-Butylbenzene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Propylbenzene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
sec-Butylbenzene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Styrene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
tert-Butylbenzene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Tetrachloroethene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Tetrahydrofuran	0 / 2	0.01 - 0.01		0.005	0.01 U	0.01 U
Toluene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
trans-1,2-Dichloroethene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
trans-1,3-Dichloropropene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Trichloroethene	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Trichlorofluoromethane	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Vinyl acetate	0 / 2	0.02 - 0.02		0.01	0.02 U	0.02 U
Vinyl chloride	0 / 2	0.01 - 0.01		0.005	0.01 U	0.01 U
Xylene, m/p	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Xylene, o	0 / 2	0.005 - 0.005		0.0025	0.005 U	0.005 U
Semivolatile Organics (mg/kg)						
1,2,4-Trichlorobenzene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
1,2-Dichlorobenzene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
1,3-Dichlorobenzene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
1,4-Dichlorobenzene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
2,2'-Dichlorodiisopropylether	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U

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2,4,5-Trichlorophenol	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
2,4,6-Trichlorophenol	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
2,4-Dichlorophenol	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
2,4-Dimethylphenol	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
2,4-Dinitrophenol	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
2,4-Dinitrotoluene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
2,6-Dinitrotoluene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
2-Chloronaphthalene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
2-Chlorophenol	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
2-Methylnaphthalene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
2-Methylphenol	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
2-Nitroaniline	0 / 2	19 - 20		9.75	20 U	19 U
2-Nitrophenol	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
3,3`-Dichlorobenzidine	0 / 2	7.4 - 7.8		3.8	7.8 U	7.4 U
3-Nitroaniline	0 / 2	19 - 20		9.75	20 U	19 U
4,6-Dinitro-2-methylphenol	0 / 2	19 - 20		9.75	20 U	19 U
4-Bromophenyl phenyl ether	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
4-Chloro-3-methylphenol	0 / 2	7.4 - 7.8		3.8	7.8 U	7.4 U
4-Chloroaniline	0 / 2	7.4 - 7.8		3.8	7.8 U	7.4 U
4-Chlorophenyl phenyl ether	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
4-Nitroaniline	0 / 2	19 - 20		9.75	20 U	19 U
4-Nitrophenol	0 / 2	19 - 20		9.75	20 U	19 U
Acenaphthene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Acenaphthylene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Acetophenone	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Aniline	0 / 2	19 - 20		9.75	20 U	19 U
Anthracene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Azobenzene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Benzo(a)anthracene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Benzo(a)pyrene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Benzo(b)fluoranthene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Benzo(ghi)perylene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Benzo(k)fluoranthene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Benzoic Acid	0 / 2	19 - 20		9.75	20 U	19 U
Benzyl alcohol	0 / 2	7.4 - 7.8		3.8	7.8 U	7.4 U
Bis(2-Chloroethoxy)methane	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Bis(2-Chloroethyl)ether	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Bis(2-Ethylhexyl)phthalate	2 / 2		4.2 - 5.2	4.7	5.2	4.2
Butylbenzylphthalate	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Chrysene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Dibenz(a,h)anthracene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U

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Dibenzofuran	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Diethylphthalate	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Dimethylphthalate	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Di-n-butylphthalate	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Di-n-octylphthalate	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Fluoranthene	2 / 2		1.9 - 2.9	2.4	2.9 J	1.9 J
Fluorene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Hexachlorobenzene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Hexachlorobutadiene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Hexachlorocyclopentadiene	0 / 2	3.7 - 3.9		1.9	3.9 UJ	3.7 UJ
Hexachloroethane	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Indeno(1,2,3-cd)pyrene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Isophorone	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
m+p-Methylphenol	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Naphthalene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Nitrobenzene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
N-Nitrosodimethylamine	0 / 2	0.011 - 0.012		0.00575	0.012 U	0.011 U
N-Nitrosodi-n-propylamine	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
N-Nitrosodiphenylamine	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Pentachlorophenol	0 / 2	19 - 20		9.75	20 U	19 U
Phenanthrene	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Phenol	0 / 2	3.7 - 3.9		1.9	3.9 U	3.7 U
Pyrene	2 / 2		2.5 - 3.3	2.9	3.3 J	2.5 J
Pesticides (mg/kg)						
4,4'-DDD	0 / 2	0.022 - 0.023		0.01125	0.023 U	0.022 U
4,4'-DDE	0 / 2	0.022 - 0.023		0.01125	0.023 U	0.022 U
4,4'-DDT	0 / 2	0.022 - 0.023		0.01125	0.023 U	0.022 U
Aldrin	0 / 2	0.022 - 0.023		0.01125	0.023 U	0.022 U
Alpha-BHC	0 / 2	0.022 - 0.023		0.01125	0.023 U	0.022 U
Beta-BHC	0 / 2	0.022 - 0.023		0.01125	0.023 U	0.022 U
Chlordane	0 / 2	0.11 - 0.12		0.0575	0.12 U	0.11 U
Delta-BHC	0 / 2	0.022 - 0.023		0.01125	0.023 U	0.022 U
Dieldrin	0 / 2	0.022 - 0.023		0.01125	0.023 U	0.022 U
Endosulfan I	0 / 2	0.022 - 0.023		0.01125	0.023 U	0.022 U
Endosulfan II	0 / 2	0.022 - 0.023		0.01125	0.023 U	0.022 U
Endosulfan sulfate	0 / 2	0.022 - 0.023		0.01125	0.023 U	0.022 U
Endrin	0 / 2	0.022 - 0.023		0.01125	0.023 U	0.022 U
Endrin ketone	0 / 2	0.022 - 0.023		0.01125	0.023 U	0.022 U
Gamma-BHC/Lindane	0 / 2	0.022 - 0.023		0.01125	0.023 U	0.022 U
Heptachlor	0 / 2	0.022 - 0.023		0.01125	0.023 U	0.022 U
Heptachlor epoxide	0 / 2	0.022 - 0.023		0.01125	0.023 U	0.022 U

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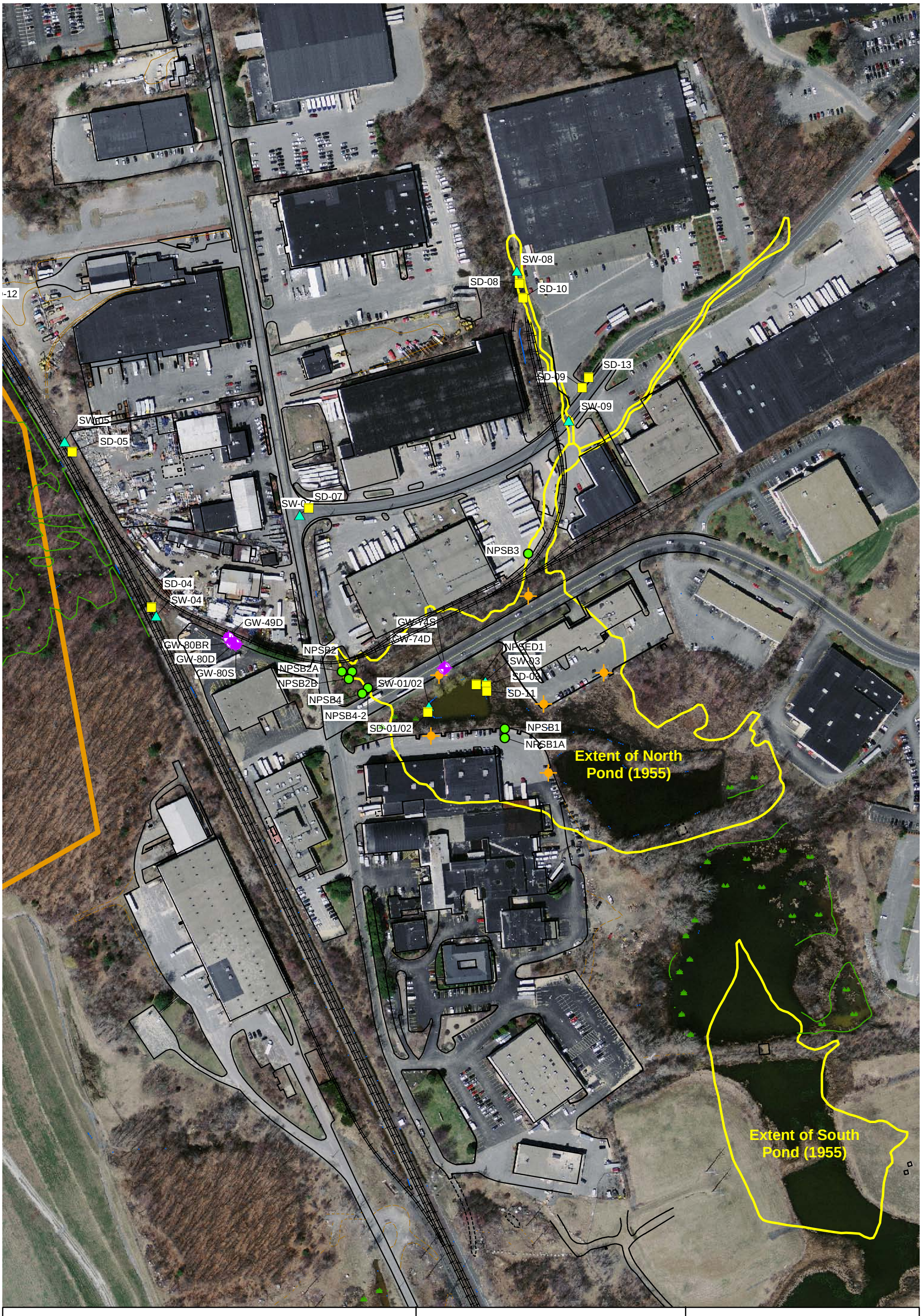
Hexachlorobenzene	0 / 2	0.022 - 0.023		0.01125	0.023 U	0.022 U
Methoxychlor	0 / 2	0.044 - 0.047		0.02275	0.047 U	0.044 U
Herbicides (mg/kg)						
2,4,5-T	0 / 2	0.000733 - 0.000896		0.000407	0.000733 U	0.000896 U
2,4,5-TP/Silvex	0 / 2	0.000733 - 0.000896		0.000407	0.000733 U	0.000896 U
2,4-D	0 / 2	0.000733 - 0.000896		0.000407	0.000733 U	0.000896 U
2,4-DB	0 / 2	0.000733 - 0.000896		0.000407	0.000733 U	0.000896 U
BUTYRIC ACID, 4-((4-CHLORO-O-TOLYL)OXY)-	0 / 2	0.00733 - 0.00896		0.004073	0.00733 U	0.00896 U
Dalapon	0 / 2	0.000733 - 0.000896		0.000407	0.000733 U	0.000896 U
Dicamba	0 / 2	0.000733 - 0.000896		0.000407	0.000733 U	0.000896 U
Dichloroprop	0 / 2	0.000733 - 0.000896		0.000407	0.000733 U	0.000896 U
Dinoseb	0 / 2	0.000733 - 0.000896		0.000407	0.000733 U	0.000896 U
MCPA	0 / 2	0.00733 - 0.00896		0.004073	0.00733 U	0.00896 U
MCPP	0 / 2	0.00733 - 0.00896		0.004073	0.00733 U	0.00896 U
Metals (mg/kg)						
Antimony	2 / 2		2.68 - 2.81	2.745	2.81 J	2.68 J
Arsenic	2 / 2		13.4 - 14.7	14.05	14.7	13.4
Chromium	2 / 2		1320 - 1580	1450	1320	1580
Chromium, Hexavalent	2 / 2		57.8 - 127	92.4	57.8 J	127 J
Chromium, Trivalent	2 / 2		1260 - 1450	1355	1260 J	1450 J
Lead	2 / 2		91.6 - 97.1	94.35	97.1	91.6
Mercury	2 / 2		0.282 - 0.369	0.3255	0.369	0.282
Thallium	1 / 2	1.14 - 1.14	1.56 - 1.56	1.065	1.56 J	1.14 UJ
Inorganics (mg/kg)						
Chloride	2 / 2		182 - 223	202.5	182	223
Cyanide, Total	0 / 2	1.6 - 1.7		0.825	1.7 U	1.6 U
Nitrogen, as Ammonia	2 / 2		233 - 245	239	245	233
Percent Solids	2 / 2		42.2 - 44.4	43.3	42.2	44.4
pH	2 / 2		6.13 - 6.26	6.195	6.26	6.13
Sulfate	2 / 2		33.8 - 35.3	34.55	35.3	33.8

Prepared By:	MJM	8/13/2009
Checked By:	BJR	8/13/2009

P:\OLIN\Wilmington\2009 Revised RI Work Plan\North Pond Soil and Sediment Data .xls Sediment
U = not detected, number shown is the reporting limit

FIGURES



Legend

- Existing Monitoring Well
- Historical Soil Boring Location
- Historical Sediment Sample Location
- Historical Surface Water Sample Location
- Approximate Extent of North and South Ponds from 1955
- Proposed Soil Boring
- 51 Eames St. Property Boundary
- Railroad
- Paved Road
- Unpaved Road
- Sidewalks
- Structures
- Surface Water
- Trails
- Wetland Boundary

MACTEC

MACTEC Engineering and Consulting
107 Audubon Road Suite 301
Wakefield, MA 01880

N

0 110 220 440 Feet

Figure 1
Historic and Proposed North Pond Sample Locations with Current Aerial Photo

Addendum I - North Pond Investigation
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared/Date: BJR 08/06/09 | Checked/Date: MJM 08/12/09

Document: P:\OLIN\Wilmington\GIS\MapDocuments\RI Work Plan\Olin_11X17_P.mxd PDF: P:\OLIN\Wilmington\2009 Revised RI Work Plan\EPA Comments\Figure 1 - Historic and Proposed North Pond Sample Locations with Current Aerial Photo.pdf 08/13/2009 3:38 PM bjroden

FINAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

VOLUME I
PROJECT OVERVIEW

OLIN CHEMICAL SUPERFUND SITE
51 EAMES STREET
WILMINGTON, MASSACHUSETTS

Submitted to:
United States Environmental Protection Agency
Region I – New England
One Congress Street
Boston, Massachusetts 02114

Submitted by:
Olin Corporation
1186 Lower River Rd
Charleston, TN 37310

Prepared by:

MACTEC Engineering and Consulting, Inc.
107 Audubon Road
Wakefield, Massachusetts 01880

Project No. 6107-09-0016.01

August 14, 2009

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Peter Thompson
Project Manager

Michael J. Murphy
Project Principal

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GLOSSARY OF ACRONYMS

AOC	Administrative Order of Consent
ARARs	Applicable or Relevant and Appropriate Requirements
AS	Air Sparging
BERA	Baseline Ecological Risk Assessment
BGS	Below Ground Surface
BHHRA	Baseline Human Health Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CRSP	Community Relations Support Plan
CSL	Calcium Sulfate Landfill
CSM	Conceptual Site Model
DAPL	Dense Aqueous Phase Liquid
DMF	Dimethylformamide
EPH	Extractable Petroleum Hydrocarbons
FSP	Field Sampling Plan
FTP	File Transfer Protocol
HASP	Health and Safety Plan
IRIS	Integrated Risk Information System
IRS	Interim Response Steps
IRSWP	Interim Response Steps Work Plan
LNAPL	Light Non-Aqueous Phase Liquid
MACTEC	MACTEC Engineering and Consulting, Inc.
MassDEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
MCP	Massachusetts Contingency Plan
MLPs	Multi-level Piezometer
MMB	Maple Meadow Brook
MMBA	Maple Meadow Brook Aquifer
MMCL	Massachusetts Maximum Contaminant Level
NCP	National Oil and Hazardous Contingency Plan
off-PWD	off-Property West Ditch
Olin	Olin Corporation
OU	Operable Unit
POP	Project Operations Plan
PRGs	Preliminary Remediation Goals

QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RAOs	Remedial Action Objectives
RI/FS	Remedial Investigation and Feasibility Study
SAP	Sampling and Analysis Plan
SASRs	Semi-Annual Status Reports
SMP	Site Management Plan
SOW	Statement of Work
UCLs	Upper Concentration Limits
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
VPH	Volatile Petroleum Hydrocarbons
VPN	Virtual Private Network

1.0 INTRODUCTION

This Project Overview has been prepared for the Olin Chemical Superfund Site (Site) in Wilmington, Massachusetts, on behalf of Olin Corporation (Olin) by MACTEC Engineering and Consulting, Inc. (MACTEC). This Project Overview is Volume I of the Remedial Investigation and Feasibility Study (RI/FS) Work Plan and is consistent with the work plan structure described in the Statement of Work (SOW), Remedial Investigation and Feasibility Study, Olin Chemical Superfund Site, prepared by the United States Environmental Protection Agency (USEPA) Region I – New England and dated June 2007. The organization of the entire RI/FS Work Plan is described below for reference.

The RI/FS Work Plan is comprised of several interrelated plans that will guide the completion of this RI/FS. They are detailed in the four volumes:

- Volume I – Project Overview
- Volume II – Site Management Plan and Community Relations Support Plan are combined in a single document.
    - Site Management Plan (SMP) provides a written understanding and commitment of how various project aspects such as access, security, contingency procedures, management responsibilities, investigation-derived waste disposal and data handling will be managed; and
    - Community Relations Support Plan (CRSP) provides a written understanding and commitment of how Olin will support the USEPA's Community Relations Program at the Site.

- Volume III – Sampling and Analysis Plan (SAP) includes two separate documents as separate volumes.
    - Volume III-A – Field Sampling Plan (FSP) provides a summary of the sampling objectives and describes the sampling program for each area of investigation at the Site;
    - Volume III-B – Quality Assurance Project Plan (QAPP) documents in writing the Site-specific objectives, policies, organizations, functional activities, sampling and analysis activities and specific quality assurance/quality control (QA/QC) activities designed to achieve the data quality objectives of the RI/FS. The QAPP provides sampling, analytical and validation procedures, as well as quality assurance and quality control requirements prepared in accordance with the format required by USEPA Region I; and

- Volume IV – Health and Safety Plan (HASP) establishes the procedures, personnel responsibilities and training necessary to protect the health and safety of all on-Site personnel during the RI/FS. The HASP provides for routine but hazardous field activities and for unexpected Site emergencies and provides requirements and procedures for biological, physical and chemical hazards to RI/FS Site workers.

The RI/FS activities will be conducted for the three Operable Units (OUs) for the Site as defined in the SOW and summarized below:

- Operable Unit 1: OU1 is defined as the approximately 50-acre Olin 51 Eames Street Property (Property) including the former facility area, the established conservation area, the on-Property ditch system, the Calcium Sulfate Landfill (CSL), and the Slurry Wall/Cap Containment Area. The OU1 RI/FS will evaluate soil, sediment, surface water (including the on-Property Ditch System), and potential vapor issues (if applicable).
- Operable Unit 2: OU2 is defined as off-Property surface water and sediment areas, including at a minimum, the off-Property East Ditch, and West Ditch. This OU will also include surface water and sediment in portions of Maple Meadow Brook (MMB) and Sawmill Brook. The OU2 RI/FS will evaluate surface water and sediment issues.
- Operable Unit 3: OU3 is defined as all on- and off-Property groundwater areas including the Maple Meadow Brook Aquifer (MMBA), groundwater beneath the Olin Property, and groundwater located south and east of the Olin Property. The OU3 RI/FS will evaluate groundwater and potential vapor issues (if applicable).

This Volume (Project Overview) of the RI/FS Work Plan complements the other three volumes that are identified above. This Project Overview addresses the following topics, required by the Administrative Order of Consent (AOC) and the SOW, that are not specifically included in the structure outlined by USEPA for the Work Plan:

- Site Description and Conceptual Site Models (CSM) (Section 2.0);
- RI/FS Project Goals and Objectives (Section 3.0);
- Data Gaps and Data Needs (Section 4.0); including identification of generic Remedial Action Objectives (RAOs), the various technologies that may be relevant for those RAOs, and the critical data needed to evaluate applicability of the technologies, and to evaluate the potential performance of technologies;
- RI/FS Work Plan Implementation and Modifications (Section 5.0);
- Project Deliverables (Section 6.0);
- Refinement of the List of Applicable or Relevant and Appropriate Requirements (ARARs) (Section 7.0); and
- Project Schedule for the RI/FS (Section 8.0).

2.0 SITE DESCRIPTION AND CONCEPTUAL SITE MODEL

The Olin Chemical Superfund Site (the Site) is located at 51 Eames Street in Wilmington, Massachusetts and encompasses the approximate 50 acre Olin Property and surrounding areas to the west, east and south, where contaminants have migrated by surface water and or groundwater transport (Figure 2.0-1). The current site features on the Property and in the surrounding off-Property area are shown in Figure 2.0-2. The Property is bounded on the east by the Massachusetts Bay Transit Authority tracks, on the south by the Woburn/Wilmington Town Line, on the west by an inactive Boston and Maine Railroad spur, and on the north by Eames Street. The Property is located in an industrialized area of Wilmington within a General Industrial zone. Intensive industrial land use occurs on the eastern, northern and western sides of the Property. The southern side of the property is bounded by the Woburn Landfill, a former municipal solid waste landfill that has been closed. Another landfill, constructed on property owned by the Spinazola Trust is located north west of the Woburn Landfill. Residential properties are located along Main Street and Cook Avenue located to the west of the Property and along Eames Street before it intersects with Woburn Street. For a historical summary of manufacturing operations and facilities, see Appendix A of Volume III-A FSP of the Project Operations Plan (POP). Historical facility features are presented in Figure 2.0-3.

There will be deed restrictions implemented to insure that the portion of the former facility property located to the north of the South Ditch and the Calcium Sulfate Landfill would remain in industrial/commercial use in the future. The deed restrictions would prohibit more sensitive land uses without prior assessment of health risks for any such uses. The portion of the facility property located area south of the South Ditch is subject to land use controls as described in the Environmental and Open Space Restriction**.**

The sources of release, mechanisms of release and migration, receiving media, and overall migration of released materials are included in the CSM discussion in Section 2.2 of Volume III-A FSP and they are presented graphically in Figure 2.2-1 of this Project Overview. The CSM is based on the information that has been collected concerning the physical features and operational history of the former facility (summarized in Appendix A of the FSP), as well as the information collected and reported during the numerous investigation and remedial activities that have been conducted since the late 1970s, and the basic principles typically applied to evaluations of fate and transport of materials in the environment. The Baseline Human Health Risk Assessment

(BHHRA) and Baseline Ecological Risk Assessment (BERA) evaluate the potential impacts of released materials on human and ecological receptors. The potential contact of human and ecological receptors to released materials in environmental media is evaluated in the context of the physical CSM and the presence of receptors at various exposure points or areas. The BHHRA CSM (Table 2.0-1) and the BERA CSM (Table 2.0-2) summarize the preliminary receptors, exposure media, exposure routes, and exposure points/areas planned for the BHHRA and BERA, respectively. These CSMs will be re-evaluated when the RI data become available. The BHHRA CSM and BERA CSM represent the overall starting points for these two risk assessments.

3.0 RI/FS PROJECT GOALS AND OBJECTIVES

According to the RI/FS SOW, the primary objective of the RI/FS shall be "to assess Site conditions and evaluate alternatives to select a remedy, to the extent necessary, for the Site as defined in the AOC, that shall be consistent with the National Oil and Hazardous Contingency Plan (NCP) (40 CFR 300) and relevant guidance."

This section identifies project objectives (both general goals and media specific objectives) and presents a discussion on how the proposed field program accomplishes the objectives. Section 3.1 presents the RI general goals, Section 3.2 presents the RI media specific objectives (including objectives for ecological assessment), and Section 3.3 presents the FS general goals.

3.1 RI – GENERAL GOALS

According to the SOW, the objectives of the RI are, consistent with the NCP and taking into consideration existing information regarding the Site, to:

1. define the sources, nature, extent, and distribution of contaminants at the Site;
2. provide sufficient information for USEPA to assess the current and future potential risks to human health and to the environment; and
3. provide sufficient information to evaluate remedial alternatives, complete a conceptual design of remedial actions, select a remedy, and issue a record of decision.

3.2 RI – SPECIFIC OBJECTIVES

The goal of the RI is stated in Section 3 of the SOW: "At the outset, the goal of the RI shall be to supplement the usable existing field data and studies summarized in the Focused RI Report, and collect all new field data which can reasonably be assumed to be necessary to complete a RI, FS, and Baseline Risk Assessment for each OU, and which will be sufficient to select a remedy for each OU." Section 3.0 of the SOW identifies 26 specific topics or items that should be characterized or described by conducting remedial investigations and writing a Remedial Investigation Report. These 26 items in the SOW are listed under the sub-heading "OBJECTIVES" beneath the section heading "REMEDIAL INVESTIGATIONS".

In addition, specific "objectives" (topics/items that need to be characterized or described) are identified for:

- Soil and Sources of Contaminants (Section 3, IV., B., 1),
- Subsurface and Hydrogeological Investigations (Section 3, IV., C., 1),
- Air Quality Assessment (Section 3, IV., D., 1),
- Surface Water and Sediments (Section 3, IV., E., 1),
- Ecological Assessment (Section 3, IV., F., 1), and
- Treatability and pilot Studies (Section 3, IV., G., 1).

The activities proposed in the RI/FS Work Plan are intended to contribute to the characterization/description of the 26 specific RI "objectives" as well as the specific objectives identified in Section 3, IV, A through G. The FSP and the QAPP were written in order to collect information that is intended to contribute to the accomplishment of these objectives.

To some extent, many of the objectives will be accomplished by compiling and evaluating previously collected information and information collected during the Remedial Investigation, collecting additional published technical and scientific information from the literature, and summarizing and critically evaluating the information in order to draw conclusions. Table 3.2-1 contains a list the specific objectives of the RI and it indicates which of the proposed activities in the Work Plan will contribute to the achievement of each of the objectives**.**

3.3 FS GENERAL GOALS

According to the SOW, the objectives of the FS portions are to:

1. establish RAOs and Preliminary Remediation Goals (PRGs), as described in NCP §300.430 (e)(2)(i);
2. review the applicability of various remedial technologies, including innovative technologies that are developed fully but lack sufficient cost or performance data for routine use at Superfund sites, to determine whether they are appropriate remedies for the Site;
3. develop remedial alternatives by screening and combining appropriate technologies based upon the screening criteria listed in the Guidance for Conducting Remedial Investigation and Feasibility Studies Under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (USEPA 540/6-89/004 OSWER-Dir. 9355.3-01) October 1988, and any criteria identified in the NCP or CERCLA, as amended;
4. evaluate each alternative or combination of alternatives that meets the above screening criteria through a detailed and comparative analysis based upon the nine (9) criteria listed in the Guidance for Conducting Remedial Investigation and

Feasibility Studies Under CERCLA (USEPA 540/6-89/004 OSWER-Dir. 9355.3-01) October 1988 and any criteria identified in the NCP or CERCLA as amended;

5. compare each alternative retained for detailed analysis to a no-action alternative, which serves as a baseline reference point for comparison; and
6. provide direction to the RI to ensure that sufficient data of the appropriate type are gathered to develop remedial alternatives (to the extent necessary).

4.0 DATA GAPS/DATA NEEDS

Section 4.1 summarizes the data gaps and data needs identified in the Draft Focused RI and in subsequent comments provided by the USEPA. The proposed activities in the RI/FS Work Plan address these data gaps. Section 4.2 identifies and discusses data requirements for identification and evaluation of remedial alternatives.

4.1 REMEDIAL INVESTIGATION

The Draft FRI Report identified data gaps associated with each of the OUs. In addition, in its review of the Draft POP, USEPA has provided comments to Olin in two letters, a meeting and conference calls. During those communications, USEPA has indicated several additional data gaps that the RI/FS Work Plan has addressed. The data gaps addressed by the activities proposed in the RI/FS Work Plan are summarized briefly below.

OU1

- Additional surface soil sampling to further delineate nature and extent of contamination in soils in the floodplain of the lower South Ditch.
- Additional surface and subsurface soil sampling to provide additional spatial coverage, including perimeter sampling, of the Property.
- Collect soil samples to characterize nature and extent of contamination beneath the temporary cover in the Slurry Wall/Cap area.
- Expand the soil sampling effort to include samples at depths between 10 feet below ground surface (bgs) and the bedrock surface.
- Expand the list of analytical parameters for soil sample analysis to include “additional Site-specific analytes” in a representative number of soil samples.
- Conduct soil sampling and analysis beneath and in the immediate vicinity of existing and historical buildings, slabs, and chemical storage tanks.
- Prepare a FSP for air quality assessment, including the evaluation of the vapor intrusion pathway.
- Additional surface water and sediment sampling and analysis for the South Ditch.
- Conduct long-term toxicity testing for sediment of the South Ditch.
- Characterize background conditions in environmental media (all three OUs).

OU2

- Additional sampling and analysis of surface water and sediments in the MMB wetland, East Ditch, off-Property West Ditch (off-PWD), Landfill Brook, and North Pond to provide a representative assessment of current conditions.
- Conduct investigations to better understand the impact of the cessation of pumping of the municipal water supply wells on surface water quality in the MMB wetland.
- Conduct investigations of the historic and current North Pond to delineate the previous lateral and vertical extent of the North Pond drainage area. Details of the proposed sampling plan have been provided in a separate addendum to the Work Plan.

OU3

- The installation and sampling of additional monitoring wells on the east side of the East Ditch to investigate lateral extent of groundwater impacts on this side of the Site.
- The installation and sampling of additional monitoring wells to delineate the down gradient extent of impacted groundwater along the Western Bedrock Valley under the MMBA, and to the south east of the Property in proximity to East Ditch in the vicinity of Presidential Way.
- A broader, representative sampling approach for the "specialty compounds" (now referred to as "additional Site-specific analytes") in the RI Analyte List including dimethylformamide (DMF), phthalic anhydride, hydrazine, acetaldehyde, formaldehyde, nonylphenol, perchlorate, diphenylamine, tin, and the products Opex® and Kempore®.
- Additional investigation of the bedrock groundwater system to understand better the nature and extent of Site-related impacts to bedrock groundwater, including areas under the MMBA; and areas near or within dense aqueous phase liquid (DAPL) pools.
- Verifying that the area immediately west of former Lake Poly is not a source of and does not contain DAPL.
- Better definition of the geometry of the Western Bedrock Valley to locate down gradient monitoring wells in vicinity of MMB, and Main Street east of the MBTA passenger rail line.
- Conduct investigations to better understand the impact of the cessation of pumping of the municipal water supply wells on groundwater quality in the MMB wetland.

4.2 DATA REQUIREMENTS FOR POTENTIAL REMEDIAL ALTERNATIVES AND TECHNOLOGIES IN THE FEASIBILITY STUDY

The SOW calls for the identification of generic RAOs, the various technologies that may be relevant for those RAOs, and the critical data needed to evaluate applicability of the technologies, and to evaluate the potential performance of technologies. The identification of critical data is conducted to provide input for the development of the RI/FS Work Plan and for the FSP in particular. RAOs have been identified for each contaminated medium and a preliminary range of remedial action alternatives and associated technologies has been identified (Table 4.2-1). Table

4.2-1 also identifies generic data requirements associated with the potential remedial alternatives and associated technologies. The major categories of the required data include the nature and distribution of contaminants, identification of background conditions, and the identification of physical, hydrologic, and hydrogeologic conditions at the Site.

It should be noted that the preliminary RAOs identified in Table 4.2-1 have been prepared using a very conservative assumption that each of the identified media for each of the OUs will require remedial action. The generic RAOs assume that for each impacted medium, the results of the baseline human health and ecological risk assessments could provide a conclusion that remedial action is required per Superfund risk management criteria. It is assumed that the baseline risk assessments would also identify risk-based, chemical-specific PRGs that could be used as preliminary RAOs. These assumptions are made here only to organize the list of preliminary RAOs in order to evaluate data needs for the initial steps of the FS.

The information gathered in the RI, the results of the associated baseline human health and ecological risk assessments, and the detailed evaluation of ARARs will be used to determine which media in each of the OUs require remediation. In addition, the RAOs will be formalized based on the RI, risk assessment, and detailed ARARs analysis. The preliminary RAOs identified in Table 4.2-1 are therefore "preliminary" – some media and exposure pathways identified in Table 4.2-1 may not require remedial action based on the findings of the completed RI and risk assessments. Table 4.2-1 identifies a range of potential remedial alternatives that may be useful in achieving media-specific ARARs and preliminary risk-based RAOs, including physical treatment, containment, natural attenuation or no action, as appropriate. The identification of potential technologies helps identify data needed to evaluate the technologies and provides an opportunity to address the needs during the field investigations. Given the history of investigations and remedial actions at the Site, the amount of information that is available for evaluating remedial alternatives is substantially greater than would typically be available for sites at the RI/FS Work Plan stage of the Superfund process. The numerous historical site investigations, feasibility studies, and remedial actions conducted at the Site have identified a considerable amount of Site-specific information to support the development of remedial alternatives.

The data requirements for evaluating the alternatives and technologies have been considered in the development of the RI/FS Work Plan. Many of the generic data needs for evaluating

alternatives and technologies have previously been addressed in site investigations, special studies, and during remedial actions implemented at the Site. The list of contaminants of potential concern, the range of concentrations in impacted media, and the volume of impacted media (requires horizontal and vertical delineation) are critical to the identification of potential alternatives and technologies. The previous investigations, in conjunction with the proposed RI investigation program, provide comprehensive information concerning those three crucial elements. The following sections summarize some of the major historical data collection activities that have produced information that will be utilized in the initial stages of the FS.

Investigations and special studies related to impacted media, source material, and fate and transport include:

- As summarized in the Draft Focused RI, the nature and extent of contamination in soil, groundwater, sediment, and surface water has been characterized in a comprehensive manner and the proposed investigations in the Draft RI/FS Work Plan will complete the nature and extent characterization.
- The DAPL is a residual source material and its chemical, geochemical, and physical characteristics have been investigated and the locations where it is present have been delineated.
    - Multi-level piezometers (MLPs) have been installed to delineate, evaluate and monitor DAPL and the DAPL/diffuse groundwater interface. Groundwater sampling has been conducted in the many ports of the MLPs to characterize the variability in chemical composition of the DAPL and the diffuse groundwater above it.
    - Ten separate inductance logging events have been conducted to characterize the vertical distribution of the dissolved constituent concentrations in DAPL and diffuse groundwater and to identify and monitor the elevation of the DAPL/diffuse groundwater interface in three DAPL pool locations.
- Upon discharge of low-pH groundwater to surface water, a metals-containing flocculent is formed in the surface water/sediment environment (particularly in the South Ditch). The chemical and physical composition of that flocculent has been investigated as well as the chemically stability of the floc under expected environmental conditions in flowing surface water.

Remedial Actions Conducted at the Site Include:

There have been several removal actions and remedial actions conducted at the Site. The remedial alternatives/technologies that have been implemented were demonstrated to be technically feasible.

- A slurry wall and a temporary cap was constructed to contain residual on-Property DAPL and overlying contaminated groundwater within a subsurface containment system to reduce the discharge of contaminated groundwater and thereby mitigate the impact on surface water and sediments in the on-Property Ditch System.
- Soil excavation and disposal was conducted:
    - Excavation and disposal of soil from three locations (Lake Poly-1, A8CW-1, and RSO-6) of soil contamination (areas termed "hot spots" per the Massachusetts Contingency Plan [MCP]);
    - Excavation and disposal of soils from the former Lake Poly Liquid Waste Disposal Area to eliminate chemical concentrations above MCP soil Upper Concentration Limits (UCLs);
    - Excavation of oily soil along the banks of the Central Pond;
    - Excavation and disposal of drums, debris, and impacted soil from the Drum Area and Debris Area;
- Removal of trimethylpentenes from the subsurface in the area referred to as the extractable petroleum hydrocarbons/volatile petroleum hydrocarbons (EPH/VPH) area via air sparging (AS)/soil vapor extraction and activated carbon removal of the trimethylpentenes and other volatile organic compound (VOCs) from the soil vapor;
- Removal of light non-aqueous phase liquid (LNAPL) from the Plant B treatment area (skimmer and other mechanical devices);
- Containment of LNAPL by creating a groundwater cone of depression (pumping groundwater) and chemical treatment of the groundwater that was withdrawn; and
- Excavation and disposal of chromium- and phthalate-impacted sediments from selected portions of the on-Property Ditch System.

The RI will provide additional information concerning the list of contaminants of potential concern, the ranges of concentrations in impacted media, and the impacted volumes (horizontal and vertical extent). No additional RI data collection needs for preliminary evaluation of those alternatives and technologies that have previously been implemented are proposed at this time.

Data needs have been identified for the preliminary evaluation of DAPL extraction and disposal. A laboratory study has been conducted and a field pilot study is planned to address these needs as described below.

Remediation-Related Studies and Pilot Tests

Remediation-related laboratory investigations have been conducted and an additional field-scale pilot test is planned.

- A laboratory column study was conducted to evaluate the feasibility of extraction of the DAPL. This study concluded that removal of 1.5 pore volumes was needed to substantially remove the contaminant mass represented by the DAPL.
- A Pilot Test is planned for DAPL removal and off-site treatment and disposal. The design for that work has been completed and bids sought.

The combination of historical investigations, special studies, previously conducted remedial actions and the proposed investigations in the Draft RI/FS Work Plan will provide the necessary information concerning the nature and extent of contamination, physical conditions at the Site, and the hydrological and hydrogeological conditions at the Site to support the development of remedial alternatives and identification of potential technologies in the initial stages of the FS.

5.0 RI/FS WORK PLAN IMPLEMENTATION AND MODIFICATIONS

The components of the approved RI/FS Work Plan will be implemented in a manner consistent with this Work Plan, including the SMP, FSP, the QAPP, the HASP and the SOW. During execution of the work and review of initial results adjustments or modifications to the RI Work Plan may be required. This section describes general methods for assessing new data, comparing newly collected and existing data and making modification to RI Work Plan documents.

5.1 PROCEDURE FOR REVISING THE SAMPLING AND ANALYSIS PLAN (FSP AND QAPP)

Prior to final approval of the RI Work Plan and implementation of the RI activities, it may become necessary to modify proposed sampling and analysis activities and analytical methodologies to meet initial objectives of the RI Work Plan and to resolve any outstanding conditions of approval by USEPA. When USEPA provides final approval of the RI Work Plan, a final electronic copy (with nine duplicate copies) and seven hard copies of the work plan will be submitted to USEPA. Final signed cover pages of the document volumes will also be provided. This process will help ensure that document holders will have a complete and correct copy of the final approved Work Plan document.

5.2 PROCEDURES FOR EVALUATING NEW SURFACE AND SUBSURFACE SOIL DATA

Previous investigations of the Site have produced a sizeable chemical data base for surface and subsurface soil media. Historical data for the 0-2 foot depth interval will be considered as surface data and 0-3 foot data, as well as deeper datasets, will be considered as subsurface soil. Data collected from 0-1 foot depths under the RI Work plan will be considered as surface soil. Soil greater than 1 foot will be considered subsurface soil. Samples collected from depths of 1-10 feet will be considered as representative of subsurface soils for risk assessment purposes. Both surface and subsurface soils will be used to evaluate the nature and extent of site-related contaminants.

The historical soil data set that is representative of current conditions represents a condition that has not been altered by regarding of the soil materials. These data will be assumed to be representative of current soil contaminant concentrations at those discrete locations, for the specific analytes for which the soil was sampled. These soil data sets would be combined with the new data to provide a more robust statistical basis for the risk assessments and assessment of nature and extent of contamination.

Olin would approach the evaluation of new and historical soil data through a program of data exploration including:

- determination of basic statistical parameters (e.g., mean, standard deviation, skewness, and kurtosis),
- examination for distribution (normal, lognormal, other or nonparametric),
- spatial analysis of surface and subsurface soil data which may involve contouring for selected site-related contaminants,
- evaluation of sufficiency (numbers of samples for each medium and/or horizon and consistency of analytes), and
- conduct of distributional (e.g., t-tests) or non-distributional (e.g., Wilcox-Rank-Sum) tests to compare the two data sets for each medium and selected analyte.

Other statistical approaches may be appropriate pending outcome of these initial data explorations. Evaluation would be performed through statistical software package tests such as in Excel, Minitab, or ProUCL. The results of the statistical evaluation, with conclusions and recommendations, would be presented in the RI Report for agency review.

5.3 PROCEDURES FOR COMPARING NEW AND EXISTING SURFACE WATER, SEDIMENT, AND GROUNDWATER DATA

Previous site investigations have produced a sizeable chemical data base for surface water, sediment, and groundwater. Additional data are to be gathered to help support risk assessments and determine any apparent trends within the respective data sets.

Olin proposes to complete a statistical evaluation of new and historical data for purposes of determining if there are statistically significant differences between the data sets. In cases where the statistical measures are consistent, the new and historical data may be combined to provide a more robust statistical basis for use in risk assessments and assessment of nature and extent of contamination.

The approach to evaluation of new and past data will be similar to soils and use a program of data exploration that includes:

- determination of basic statistical parameters (e.g., mean, standard deviation, skewness, and kurtosis),

- examination for distribution (normal, lognormal, other or nonparametric),
- trend analysis (Mann-Kendall test),
- evaluation of sufficiency (numbers of samples for each medium and consistency of analytes), and
- conduct of distributional (e.g., t-tests) or non-distributional (e.g., Wilcox-Rank-Sum) tests to compare the two data sets for each medium and selected analyte.

Evaluation would be performed through statistical software package tests such as in Excel®, Minitab, or ProUCL. The results of the statistical evaluation, with conclusions and recommendations, would be presented in a report for agency review.

In addition, for surface water, time series data plots will be prepared for specific analytes of interest (for example ammonia, and chromium in the South Ditch) at specific monitoring locations. Other visual data analysis may include plots of specific analyte concentrations from upstream to downstream locations for individual sampling events.

Assessment of groundwater data will also make use of time series plot and graphic representations such as cross sections and data chemical box or contour figures. The existing statistical analysis of groundwater and surface water in the MMBA will also be updated using the statistical methods presented in the Appendix E of the Draft Focused RI Report (MACTEC, 2007). These methods include comparison to previously developed control limits (Shewhart-CUSUM) and Mann-Whitney (rank-sum) to evaluate differences in water quality pre-and post cessation of pumping, and trends (Sen slope estimates). Plots may also include time series plots and box plots to visually compare data sets.

5.4 PROCESS FOR IDENTIFICATION AND EVALUATION OF DATA NEEDS, GAPS AND UNCERTAINTIES

During progress of the RI investigations, data collection activities for certain media within specific OUs will be completed and the analytical data received. When a completed data set for a media is received from the laboratory (e.g., final surface and subsurface OU1 soil data), the data will undergo validation in accordance with procedures detailed in the QAPP. Validated data will be up loaded to the project database in accordance with data management procedures described in the QAPP. Initial data tables (crosstabs) and data figures will be prepared for initial data assessment purposes. Crosstab tables will be used to initially screen data against regulatory criteria for the specific media under evaluation (for example Maximum Contaminant Levels

[MCLs], Massachusetts Maximum Contaminant Levels [MMCLs], Industrial Soil Regional Screening Levels [RSLs], background values, etc.) and make an initial assessment whether the current data set, in combination with existing historical data, appears sufficient to determine the nature and extent of site-related contaminants in a given media and OU. Validated RI data not previously submitted will be included in a separate section of the Semi-Annual Status Reports (SASRs).

On a periodic basis, (to be determined by the progress of work performed, the receipt and validation of laboratory analytical data), the Olin web based data query application will be updated providing USEPA access to the new validated data. USEPA will also be provided with an electronic file listing the coordinates and depth of soil samples, the coordinates of surface water and sediment samples, and the coordinates and elevation of newly installed monitoring well screens.

Olin will make an initial assessment of the analytical data for a specific OU and media when it is complete and provide its assessment of any remaining data gaps to USEPA. These interim data assessment points would include:

- Surface and subsurface soil for OU1 after completion of currently proposed sampling activities, data receipt, and final validation,
- Surface water and sediment for OU1 after completing the first round of data collection, data receipt, and final validation,
- Surface water and sediment for OU2 after completing the first round of data collection, data receipt, and final validation, and
- Groundwater for OU3 after completing the first synoptic round of water level measurements and groundwater sampling, data receipt, and final validation.

Olin will prepare and present an evaluation of data gaps and uncertainties in (a) progress meeting(s) with USEPA. Olin will recommend to USEPA whether data gaps are present requiring additional data collection activities, whether modification of analytical or sampling programs are warranted, or when all proposed data collection activities are complete, whether data sets are adequate to proceed with the preparation of an RI report and baseline risk assessments.

5.5 PROCESS FOR DEVELOPING OPERABLE UNIT SPECIFIC SUPPLEMENTAL WORK PLANS

During the progress of field investigations, the need for limited additional information may become apparent as a result of interim data assessment activities described above or for other reasons. These data needs could range from limited data collection activities to treatability studies. If USEPA, after consultation with the Massachusetts Department of Environmental Protection (MassDEP), determines that additional data are necessary to meet the objectives of the RI/FS, Olin will prepare an Additional Field Studies Work Plan that describes the data to be obtained. Olin will submit the Additional Field Studies Work Plan to USEPA and MassDEP for review, and will perform the necessary studies after receiving a notice to proceed with the additional field studies by USEPA. The Additional Field Studies Work Plan will be scoped to meet the field data collection objectives of the RI/FS (Section 1 of the SOW), be consistent with the procedures in the POP, and fulfill the requirements of the Site Characterization (Section 3 of the SOW).

The Additional Field Studies Work Plan will be considered to be an addendum to the RI/FS Work Plan.

6.0 PROJECT DELIVERABLES

6.1 SEMI-ANNUAL STATUS REPORTS

The SOW requires the submittal of SASRs that provide an ongoing summary of data and evaluations. One SASR covering all of the OUs is required and contains the following information:

- Text summary of field activities for a period inclusive of the previous six months;
- Data summaries;
- Laboratory sheets;
- Supporting figures;
- Waste manifests; and
- Other relevant information.

Olin has submitted SASRs and will continue to submit them consistent with the SOW. The most recent SASR submitted to the USEPA covered the period of June 2008 to November 2008 (MACTEC, 2008).

To date, the SASRs have discussed field activities for three ongoing Interim Response Steps (IRSs) as described in the Interim Response Steps Work Plan (IRSWP).

The three specific IRSs are summarized below and include:

- DAPL Extraction Pilot Test in the off-PWD Area;
- Slurry Wall/Cap – monitoring of groundwater and surface water in the area surrounding the Slurry Wall and inspection of the temporary cap; and
- Plant B – operation, maintenance and monitoring of the groundwater recovery/treatment system that was designed to remove and control migration of LNAPL. The Plant B component of the SASR will include results of the pumping rate reduction test when that activity commences.

Future SASRs will document the activities for the IRSs (as long as they continue) as well as the RI/FS activities for the three OUs.

6.2 HUMAN HEALTH RISK ASSESSMENT DELIVERABLES

According to the SOW, prior to the submission of the Draft Baseline Risk Assessment Reports for each OU, portions of the Baseline Risk Assessments, in the form of interim deliverables, shall be submitted. An outline for the BHHRA is available in Appendix A to Volume I of this RI/FS Work Plan. Tables that will be used to present the information in each of the BHHRA Interim Deliverables and the BHHRA will provide the information required by Risk Assessment Guidance for Superfund, Part D.

The Human Health Risk Assessment will be completed in accordance with current guidance, procedures, assumptions, methods, and formats, including those listed below.

For Both Human Health and Ecological Risk Assessments:

U.S, USEPA Region I Waste Management Division Risk Updates: December, 1992.

For Baseline Human Health Risk Assessments:

- Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03 (USEPA, March 25, 1991).
- USEPA Region I Supplemental Risk Assessment Guidance for the Superfund Program Part 1: Public Health Risk Assessment (USEPA 901/5/89-001, June 1989.
- Risk Assessment Guidance for Superfund (RAGS). Volume I: Human Health Evaluation Manual (Part A) interim final, USEPA 540/1/-89, December 1989.
- Development of Risk-Based Preliminary Remediation Goals (Part B) publication 9285.7-01B, December 1991, PB92-963333.
- Risk Evaluation of Remedial Alternatives (Part C), publication 9285.7-01C, December 1991, PB92-963334.
- Standardized Planning, Reporting and Review of Superfund Risk Assessments (Part D), publication 9285.7-47, December 2001, PB97-963311.
- Supplemental Guidance for Dermal Risk Assessment (Part E), publication 9285.7-02EP, July 2004, PB99-963312.
- Supplemental Guidance to RAGS: Calculating the Concentration Term, (Publication 9285.7-08I, June 22, 1992).
- Guidance for Data Usability in Risk Assessment (Part A) (publication 9285.7-09A, April 1992, PB92-963356).
- Guidance for Data Usability in Risk Assessment (Part B) (publication 9285.7-09B, May 1992, PB92-963362).

- Dermal Exposure Assessment: Principles and Applications (USEPA 600/8-91/011B, January, 1992).
- Air/Superfund National Technical Guidance Study Series, Volumes I, II, III, and IV (USEPA 450/1-89-001, 002, 003, 004, July 1989).
- USEPA Superfund's "Process for Conducting Probabilistic Risk Assessment," RAGS (Part A), Volume III, (USEPA 540-R-02-002, December 2001).
- Guidance for Comparing Background and Chemical Concentration in Soil for CERCLA Sites, September 2002.
- Role of Background in the CERCLA Cleanup Program, April 26, 2002.
- Role of the Baseline Risk Assessment in Superfund Remedy Selection, April 22, 1991.
- Soil Screening Guidance, December 2002.
- Land Use in the CERCLA Remedy Selection Process, OSWER Directive No. 9355.7-04.
- Revised Policy on Performance of Risk Assessments During RI/FSs Conducted by PRPs.
- Vapor Intrusion Guidance (Draft), November 29, 2002.
- Policy on Evaluating Health Risks to Children.
- Guidance Manual for Health Risk Assessments of Hazardous Substance Sites.

Additional guidelines that may be used to prepare and perform the risk assessment are:

a. Carcinogen Risk Assessment (51 FR 33992, September 24, 1986);
b. Mutagenicity Risk Assessment (51 FR 34006, September 24, 1986);
c. The Health Risk Assessment of Chemical Mixtures (51 FR 34014, September 24, 1986);
d. The Health Assessment of Suspect Developmental Toxicants (56 FR 63798, December 5, 1991); and
e. Exposure Assessment Guidelines (57 FR 22887, 1992).

A Draft BHHRA for each OU will be submitted to the USEPA after the completion and acceptance of the following three Interim Deliverables.

6.2.1 First Interim Deliverable

The First Interim Deliverable for the human health risk assessment will include the initial hazard identification and exposure assessment. The hazard identification will include a compilation of all available sampling data for each OU by medium. Data sets will be identified for use in the quantitative risk evaluation, and contaminants of potential concern will be identified. Data summaries will be provided in tabular format with the information specified in Section 7.I.A.1 of

the SOW provided. The process used for selection of contaminants of potential concern will be outlined in narrative form.

The exposure assessment will identify all plausible present and potential future exposure pathways and parameters. Identification of the exposure pathways will include discussions of the source, transport medium, and exposure route. Exposure scenarios will be outlined in narrative form, and exposure pathways will be identified in a flow chart format.

6.2.2 Second Interim Deliverable

The Second Interim Deliverable for the human health risk assessment will include any necessary revisions to the hazard identification or exposure assessment submitted as part of the First Interim Deliverable. Revisions will be based on comments received from USEPA. Any additional, newly acquired validated data will be incorporated in this submittal.

The Second Interim Deliverable also includes a dose-response evaluation. The dose-response evaluation will identify the nature and probability of adverse health effects which could be expected to result from exposure to contaminants of potential concern. The dose-response evaluation will include separate characterizations for carcinogenic and non-carcinogenic effects. Integrated Risk Information System (IRIS) will be preferentially used in obtaining the dose-response criteria.

6.2.3 Third Interim Deliverable

The Third Interim Deliverable for the human health risk assessment will include an exposure assessment that will be an estimation of the range of possible exposures which may result from actual or threatened releases of hazardous substances from the Site. The range of possible exposures will include a calculation of the average and reasonable maximum exposure levels associated with the contaminant concentration. The conservative exposure parameters developed for each exposure scenario in the First Interim Deliverable will be used in these calculations. The exposure point concentrations and exposure dose levels will be presented in narrative and tabular forms.

This Interim Deliverable will also include a risk characterization to integrate the information developed during the hazard identification, dose response evaluation and the exposure

assessment. The risk characterization will be presented in tabular form and will summarize carcinogenic and noncarcinogenic health risks separately.

A discussion of the uncertainties and limitations of the analysis will be provided in the Third Interim Deliverable. Major limitations will be outlined, as will sources of uncertainty. Any uncertainties will be described based on implications for the cumulative risk calculations, (i.e., did the uncertainty result in an over- or under-estimation of risk?).

6.3 ECOLOGICAL RISK ASSESSMENT DELIVERABLES

According to the SOW, prior to the submission of the Draft Baseline Risk Assessment Reports for each OU, portions of the Baseline Risk Assessments, in the form of interim deliverables, shall be submitted. An outline for the BERA is available in Appendix B of this Volume of RI/FS Work Plan.

The Ecological Risk Assessment shall be completed in accordance with current guidance, procedures, assumptions, methods, and formats, including those listed below.

For Both Human Health and Ecological Risk Assessments:

U.S. USEPA Region I Waste Management Division Risk Updates: December, 1992.

For Baseline Ecological Risk Assessments:

- Risk Assessment Guidance for Superfund, Volume II: Environmental Evaluation (USEPA 540/1-89/001, March 1989).
- Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference Document (USEPA 600/3-89/013, March 1989).
- Wildlife Exposure Factors Handbook, Volumes I and II (USEPA EPA/600/R-93/187a, EPA/600/R-93/187b, December 1993).
- Ecological Risk Assessment Guidance for Superfund: Process for Designing & Conducting Ecological Risk Assessments (USEPA OSWER Directive, No. 9285.7-25, February 1997).
- Guidelines for Ecological Risk Assessment (USEPA EPA/630/R-95/002F, April 1998).
- Guidance for Data Quality Assessment: Practical Methods for Data Analysis (USEPA EPA/600/R-96/084, July 2000).

- The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments, ECO Update (USEPA 540/F-01/014, June 2001).
- Generic Ecological Assessment Endpoints for Ecological Risk Assessment (USEPA EPA/630/P-02/004F, October 2003).
- Framework for Metals Risk Assessment (USEPA EPA 120/R-07/001, March 2007).

Additional guidelines that may be used to prepare and perform the risk assessment are:

a. Carcinogen Risk Assessment (51 FR 33992, September 24, 1986);
b. Mutagenicity Risk Assessment (51 FR 34006, September 24, 1986);
c. The Health Risk Assessment of Chemical Mixtures (51 FR 34014, September 24, 1986);
d. The Health Assessment of Suspect Developmental Toxicants (56 FR 63798, December 5, 1991); and
e. Exposure Assessment Guidelines (57 FR 22887, 1992).

A Draft BERA for OU1 and OU2 each will be submitted to the USEPA after the completion and acceptance of the following three Interim Deliverables.

6.3.1 First Interim Deliverable

The First Interim Deliverable for the ecological risk assessment is the hazard identification. The hazard identification includes both a site characterization and the selection of contaminants of potential concern and indicator species and endpoints.

The site characterization shall include a discussion of the CSM and site features of ecological interest. Preliminary ecological CSMs are attached as Figures 6.3-1 and 6.3-2. Habitat types and associated species found or expected to be found at the Site or adjacent to the Site will be detailed in this section. Any species that are federally endangered or threatened, of special concern to the State, that are Trustee resources, or other species of interest will be described as part of the site characterization.

The section detailing the selection of contaminants of potential concern will include discussions regarding the list of contaminants of potential concern and the criteria used in the selection. The criteria for selecting the indicator species and endpoints will be described in this submittal.

6.3.2 Second Interim Deliverable

The Second Interim Deliverable for the ecological risk assessment will include any necessary revisions to the hazard identification submitted as part of the First Interim Deliverable. Revisions will be based on comments received from USEPA. Any additional, newly acquired validated data will be incorporated in this submittal.

The Second Interim Deliverable will also include a description of the ecological exposure assessment. The exposure assessment includes a discussion of the source characterization and the selection of exposure pathways, the fate and transport analysis, a description of the exposure scenarios with an integrated exposure analysis, and the uncertainty analysis.

6.3.3 Third Interim Deliverable

The Third Interim Deliverable for the ecological risk assessment will consist of any necessary revisions to the Second Interim Deliverable. Revisions will be based on comments received from USEPA. Any additional, newly acquired validated data will be incorporated in this submittal. Although the SOW does not require the submission of a risk characterization and discussion of uncertainties and limitations as part of the Third Interim Deliverable for the ecological risk assessment, this information will be submitted in a manner that is parallel in structure and content to the Third Interim Deliverable for the human health risk assessment.

6.4 REMEDIAL INVESTIGATION REPORTS

A Draft Remedial Investigation Report will be prepared and submitted to USEPA for each OU. Consistent with the SOW, after response to comments and appropriate revisions, a Final Remedial Investigation Report will be prepared and submitted to USEPA for each OU. Draft and Final Remedial Investigation Reports will be submitted in hardcopy and in Adobe™ Acrobat format. These reports will be structured based on the outline for the Remedial Investigation Report that was provided in the SOW and which is reproduced in Appendix E of this RI/FS Work Plan.

Consistent with the SOW, each Remedial Investigation Report will include the methods, data gathered, and analysis of results of all RI activities, as well as detail from all studies and findings that have been completed at the Site. Each Remedial investigation Report will indicate how well the studies addressed the goals and objectives for the RI/FS, for the RI, and the study-specific objectives as discussed in Sections 1.0 and 3.0 of the SOW. Any differences between actual field

work and the activities contained in the approved RI/FS Work Plan will be identified. The Remedial Investigation Report for each OU will include the associated BHHRA and BERA. Any objectives that were not accomplished by the RI activities will be identified.

Upon request, Olin will also provide USEPA with text and tables in MS Word, and provide data and drawings in workable and widely accepted electronic formats or alternatively, provide USEPA and USEPA's consultant with access to electronic text, tables, data and drawings though a Virtual Private Network (VPN), File Transfer Protocol (FTP) or other acceptable electronic data-sharing link.

6.5 FEASIBILITY STUDY REPORTS

Consistent with the SOW, a Development and Initial Screening of Alternatives Report will be submitted to USEPA and MassDEP for review for each OU, as appropriate. If an alternative is to be eliminated, it will be screened out for clearly stated reasons contained in the NCP (40 CFR Part 300) and other USEPA guidance. The report will contain a chart of all alternatives and the analysis of the basic factors. The report will justify deleting, refining, or adding alternatives. It will also identify the data needed to select a remedy and the work plans for studies designed to obtain the data. The report will contain charts, graphs, and other graphics to display the anticipated effectiveness of the alternatives. This report will also describe the methods by which Olin will evaluate potential remedial alternatives to be submitted to USEPA and MassDEP for review.

A Draft Feasibility Study Report will be prepared and submitted to USEPA for each OU. Consistent with the SOW, after response to comments and appropriate revisions, a Final Feasibility Study Report will be prepared and submitted to USEPA for each OU. Draft and Final Feasibility Study Reports will be submitted in hardcopy and in Adobe™ Acrobat format. These reports will be structured based on the outline for the Feasibility Study Report that was provided in the SOW and which is reproduced in Appendix F of this RI/FS Work Plan.

7.0 REFINEMENT OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS ("ARARS")

The preliminary list of ARARs was submitted to USEPA as Appendix G to the Draft Focused RI Report (MACTEC, 2007). This section provides an update to the list of ARARs, including probable Federal, State, and any local requirements identified in the Focused RI Report. Table 7.0-1 identifies preliminary action-specific ARARs, criteria, advisories, and guidance, Table 7.0-2 identifies preliminary chemical-specific ARARs, and Table 7.0-3 identifies preliminary location-specific ARARs. Once work on the FS for each OU begins, the preliminary list of probable ARARs included in the Focused RI Report, and updated in the RI/FS Work Plan, will be refined, and additional ARARs will be sought during a thorough search of applicable Federal and State environmental statutes and regulations. In the FS, all chemical- and location-specific ARARs, as well as action-specific ARARs, will be identified after the development and Initial Screening of the Remedial Alternatives.

8.0 PROJECT SCHEDULE

The proposed RI/FS schedule is summarized in Figure 8.0-1. The proposed schedule includes a single field program. The findings of the field program may indicate the need for additional field work and the schedule for one or more of the OUs may require future adjustment on that basis. This proposed schedule, however, assumes that the RI/FS activities for the three OUs will begin and proceed simultaneously. Given the uncertainty in the date of Work Plan approval, the proposed schedule has been prepared in the context of time from approval of the RI/FS Work Plan rather than specific calendar dates. It is expected that RI/FS field activities will begin within four weeks of the RI/FS Work Plan approval by USEPA.

The schedule considers the level of effort and sequence of several major RI/FS activities, including the following:

- Remedial Investigation
  - Field Work (single program proposed – includes two separate sampling events for some media such as surface water)
  - Laboratory Analysis
  - Data Validation
  - Data compilation, summarization, and evaluation (database)
  - Preparation and Submittal of SASRs
  - Preparation of RI Report
  - Preparation of BHHRA (Interim Deliverables Process)
  - Preparation of BERA (interim Deliverables Process)
  - Submittal of Draft RI Report (including risk assessments)
  - Response to Comments
  - Submittal of Final RI Report
- Feasibility Study
  - Detailed Scoping of Feasibility Study
  - Preparation of Development and Initial Screening of Alternatives Report
  - Preparation of Feasibility Study
  - DAPL Extraction Pilot Test
  - Submittal of Draft FS Report
  - Response to Comments
  - Submittal of Final FS Report

The schedule would be updated (with USEPA approval) if additional field activities or FS data collection efforts are required beyond the proposed activities in the RI/FS Work Plan. If such activities are required, one or more OUs may need to be placed on a separate schedule.

9.0 REFERENCES

Air/Superfund National Technical Guidance Study Series, Volumes I, II, III, and IV (USEPA 450/1-89-001, 002, 003, 004, July 1989).

Carcinogen Risk Assessment (51 FR 33992, September 24, 1986).

Dermal Exposure Assessment: Principles and Applications (USEPA 600/8-91/011B, January, 1992).

Development of Risk-Based Preliminary Remediation Goals (Part B) publication 9285.7-01B, December 1991, PB92-963333.

Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference Document (USEPA 600/3-89/013, March 1989).

Ecological Risk Assessment Guidance for Superfund: Process for Designing & Conducting Ecological Risk Assessments (U.S. USEPA OSWER Directive, No. 9285.7-25, February 1997).

Exposure Assessment Guidelines (57 FR 22887, 1992).

Guidance for Data Usability in Risk Assessment (Part A) (publication 9285.7-09A, April 1992, PB92-963356).

Guidance for Data Usability in Risk Assessment (Part B) (publication 9285.7-09B, May 1992, PB92-963362).

Guidance for Comparing Background and Chemical Concentration in Soil for CERCLA Sites, September 2002.

Guidance Manual for Health Risk Assessments of Hazardous Substance Sites.

Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03 (USEPA, March 25, 1991).

Land Use in the CERCLA Remedy Selection Process, OSWER Directive No. 9355.7-04.

MACTEC Engineering and Consulting, Inc. (MACTEC), 2007. *Draft Focused Remedial Investigation Report*, Olin Chemical Superfund Site, Wilmington, Massachusetts. October, 2008.

MACTEC, 2008. *Semi-Annual Status Report No. 3, June 2008 – November 2008*, Olin Chemical Superfund Site, Wilmington, Massachusetts. December 29, 2008.

Mutagenicity Risk Assessment (51 FR 34006, September 24, 1986).

Policy on Evaluating Health Risks to Children.

Revised Policy on Performance of Risk Assessments During RI/FSs Conducted by PRPs.

Risk Assessment Guidance for Superfund (RAGS). Volume I: Human Health Evaluation Manual (Part A) interim final, USEPA 540/1/-89, December 1989.

Risk Assessment Guidance for Superfund, Volume II: Environmental Evaluation (USEPA 540/1-89/001, March 1989).

Risk Evaluation of Remedial Alternatives (Part C), publication 9285.7-01C, December 1991, PB92-963334.

Role of the Baseline Risk Assessment in Superfund Remedy Selection, April 22, 1991.

Role of Background in the CERCLA Cleanup Program, April 26, 2002.

Soil Screening Guidance, December 2002.

Standardized Planning, Reporting and Review of Superfund Risk Assessments (Part D), publication 9285.7-47, December 2001, PB97-963311.

Supplemental Guidance to RAGS: Calculating the Concentration Term, (Publication 9285.7-08I, June 22, 1992).

Supplemental Guidance for Dermal Risk Assessment (Part E), publication 9285.7-02EP, July 2004, PB99-963312.

The Health Risk Assessment of Chemical Mixtures (51 FR 34014, September 24, 1986).

The Health Assessment of Suspect Developmental Toxicants (56 FR 63798, December 5, 1991).

The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments, ECO Update, (USEPA 540/F-01/014, June 2001).

USEPA Region I Supplemental Risk Assessment Guidance for the Superfund Program Part 1: Public Health Risk Assessment (USEPA 901/5/89-001, June 1989.

US USEPA Region I Waste Management Division Risk Updates: December, 1992.

USEPA Superfund's "Process for Conducting Probabilistic Risk Assessment," RAGS (Part A), Volume III, (USEPA 540-R-02-002, December 2001).

Vapor Intrusion Guidance (Draft), November 29, 2002.

TABLES

Table 2.0-1
Human Health Conceptual Site Model

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

OPERABLE UNIT	MEDIUM	HUMAN HEALTH EXPOSURE AREA	RECEPTOR	EXPOSURE PATHWAYS
OU1	SURFACE SOIL	AREA A	INDUSTRIAL WORKER	INGESTION
				DERMAL
			CONSTRUCTION WORKER	INGESTION
				DERMAL
				INHALATION (DUST)
			TRESPASSER	INGESTION
				DERMAL
	SUBSURFACE SOIL		CONSTRUCTION WORKER	INGESTION
				DERMAL
				INHALATION (DUST)
	SURFACE SOIL	AREA B	INDUSTRIAL WORKER	INGESTION
				DERMAL
			CONSTRUCTION WORKER	INGESTION
				DERMAL
				INHALATION (DUST)
			TRESPASSER	INGESTION
				DERMAL
	SUBSURFACE SOIL		CONSTRUCTION WORKER	INGESTION
				DERMAL
				INHALATION (DUST)
	SURFACE SOIL	AREA C	VISITOR	INGESTION
				DERMAL
	SURFACE WATER	SOUTH DITCH	INDUSTRIAL WORKER	INGESTION
				DERMAL
			TRESPASSER	INGESTION
				DERMAL
			AREA C VISITOR	INGESTION
				DERMAL
		EPHEMERAL DRAINAGE	AREA C VISITOR	INGESTION
				DERMAL

Table 2.0-1
Human Health Conceptual Site Model

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

OPERABLE UNIT	MEDIUM	HUMAN HEALTH EXPOSURE AREA	RECEPTOR	EXPOSURE PATHWAYS
	SEDIMENT	UPPER SOUTH DITCH	INDUSTRIAL WORKER	INGESTION
				DERMAL
			TRESPASSER	INGESTION
				DERMAL
			AREA C VISITOR	INGESTION
				DERMAL
		LOWER SOUTH DITCH	INDUSTRIAL WORKER	INGESTION
				DERMAL
			TRESPASSER	INGESTION
				DERMAL
			AREA C VISITOR	INGESTION
				DERMAL
		CENTRAL WETLAND	INDUSTRIAL WORKER	INGESTION
				DERMAL
			TRESPASSER	INGESTION
				DERMAL
		WEST DITCH WETLAND	INDUSTRIAL WORKER	INGESTION
				DERMAL
			TRESPASSER	INGESTION
				DERMAL
		EPHEMERAL DRAINAGE	AREA C VISITOR	INGESTION
				DERMAL
OU2	SURFACE WATER	EAST DITCH AND DOWNSTREAM	TRESPASSER	INGESTION
				DERMAL
		OFF-PROPERTY WEST DITCH	TRESPASSER	INGESTION
				DERMAL
		MAPLE MEADOW BROOK WETLAND	TBD/trespasser	TBD
	SEDIMENT	EAST DITCH AND DOWNSTREAM	TRESPASSER	INGESTION
				DERMAL
		OFF-PROPERTY WEST DITCH	TRESPASSER	INGESTION
				DERMAL
		MAPLE MEADOW BROOK WETLAND	TBD	TBD

Table 2.0-1
Human Health Conceptual Site Model

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

OPERABLE UNIT	MEDIUM	HUMAN HEALTH EXPOSURE AREA	RECEPTOR	EXPOSURE PATHWAYS
OU3	GROUNDWATER	RESIDENTIAL WELLS (POTABLE & HOUSEHOLD USES)	RESIDENT	INGESTION DERMAL INHALATION
		INDUSTRIAL PRODUCTION WELLS	WORKER	DERMAL INHALATION
		CURRENT OR POTENTIAL DRINKING WATER SOURCE AREA	COMMUNITY RESIDENT	INGESTION DERMAL INHALATION
		VOC-IMPACTED SHALLOW GROUNDWATER AND BUILDABLE LAND OR EXISTING INDUSTRIAL)ON-PROPERTY AND OFF-PROPERTY)	WORKER	INHALATION
		VOC-IMPACTED SHALLOW GROUNDWATER AND BUILDABLE LAND OR EXISTING RESIDENTIAL (OFF-PROPERTY)	RESIDENT	INHALATION
		POINTS OF GROUNDWATER DISCHARGE TO SURFACE WATER (SOUTH DITCH OR EAST DITCH?)	RISK EVALUATED BY EVALUATING SW AND SED, BUT GROUNDWATER IS SOURCE TERM FOR FS	
		MUNICIPAL WATER SUPPLY WELLS		

Prepared By / Date: MJM 02/24/09
Checked By / Date: SEH 02/24/09

Note: This preliminary human health conceptual site model will be revisted when the RI data are compiled and summarized and the spatial distribution of contaminants is evaluated. There may be revisions to the receptor groups, exposure areas or exposure points, and exposure pathways, and these revisions would be incorporated into the First Interim Deliverable for the BHHRA.

Table 2.0-2
Ecological Conceptual Site Model

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

OPERABLE UNIT	MEDIUM	ECOLOGICAL EXPOSURE AREA	RECEPTOR	EXPOSURE PATHWAYS [1]
OU1	SURFACE SOIL	CENTRAL WETLAND & EPHEMERAL DRAINAGE TERRESTRIAL AREAS	TERRESTRIAL PLANTS	CHEMICAL UPTAKE
			TERRESTRIAL INVERTEBRATES	INGESTION DIRECT CONTACT
			TERRESTRIAL BIRDS	INGESTION
			TERRESTRIAL MAMMALS	INGESTION
	SURFACE WATER	UPPER AND LOWER SOUTH DITCH	AQUATIC PLANTS	CHEMICAL UPTAKE
			AQUATIC INVERTEBRATES	INGESTION DIRECT CONTACT
			AMPHIBIANS	INGESTION DIRECT CONTACT
			SEMI-AQUATIC BIRDS	INGESTION
			SEMI-AQUATIC MAMMALS	INGESTION
		CENTRAL POND	AQUATIC PLANTS	CHEMICAL UPTAKE
			AQUATIC INVERTEBRATES	INGESTION DIRECT CONTACT
			AMPHIBIANS	INGESTION DIRECT CONTACT
			SEMI-AQUATIC BIRDS	INGESTION
			SEMI-AQUATIC MAMMALS	INGESTION
		WEST DITCH WETLAND	AQUATIC PLANTS	CHEMICAL UPTAKE

Table 2.0-2
Ecological Conceptual Site Model

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

OPERABLE UNIT	MEDIUM	ECOLOGICAL EXPOSURE AREA	RECEPTOR	EXPOSURE PATHWAYS [1]
			AQUATIC INVERTEBRATES	INGESTION DIRECT CONTACT
			AMPHIBIANS	INGESTION DIRECT CONTACT
			SEMI-AQUATIC BIRDS	INGESTION
			SEMI-AQUATIC MAMMALS	INGESTION
	SEDIMENT	UPPER AND LOWER SOUTH DITCH	AQUATIC PLANTS	CHEMICAL UPTAKE
			AQUATIC INVERTEBRATES	INGESTION DIRECT CONTACT
			AMPHIBIANS	INGESTION DIRECT CONTACT
			SEMI-AQUATIC BIRDS	INGESTION
			SEMI-AQUATIC MAMMALS	INGESTION
		CENTRAL POND	AQUATIC PLANTS	CHEMICAL UPTAKE
			AQUATIC INVERTEBRATES	INGESTION DIRECT CONTACT
			AMPHIBIANS	INGESTION DIRECT CONTACT
			SEMI-AQUATIC BIRDS	INGESTION
			SEMI-AQUATIC MAMMALS	INGESTION

Table 2.0-2
Ecological Conceptual Site Model

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

OPERABLE UNIT	MEDIUM	ECOLOGICAL EXPOSURE AREA	RECEPTOR	EXPOSURE PATHWAYS [1]
		WEST DITCH WETLAND	AQUATIC PLANTS	CHEMICAL UPTAKE
			AQUATIC INVERTEBRATES	INGESTION DIRECT CONTACT
			AMPHIBIANS	INGESTION DIRECT CONTACT
			SEMI-AQUATIC BIRDS	INGESTION
			SEMI-AQUATIC MAMMALS	INGESTION
OU2	SURFACE WATER	OFF-PROPERTY WEST DITCH	AQUATIC PLANTS	CHEMICAL UPTAKE
			AQUATIC INVERTEBRATES	INGESTION DIRECT CONTACT
			AMPHIBIANS	INGESTION DIRECT CONTACT
			SEMI-AQUATIC BIRDS	INGESTION
			SEMI-AQUATIC MAMMALS	INGESTION
		EAST DITCH	AQUATIC PLANTS	INGESTION DIRECT CONTACT
			AQUATIC INVERTEBRATES	INGESTION DIRECT CONTACT
			AMPHIBIANS	INGESTION
			SEMI-AQUATIC BIRDS	INGESTION
			SEMI-AQUATIC MAMMALS	INGESTION

Table 2.0-2
Ecological Conceptual Site Model

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

OPERABLE UNIT	MEDIUM	ECOLOGICAL EXPOSURE AREA	RECEPTOR	EXPOSURE PATHWAYS [1]
	SEDIMENT	OFF-PROPERTY WEST DITCH	AQUATIC PLANTS	CHEMICAL UPTAKE
			AQUATIC INVERTEBRATES	INGESTION DIRECT CONTACT
			AMPHIBIANS	INGESTION DIRECT CONTACT
			SEMI-AQUATIC BIRDS	INGESTION
			SEMI-AQUATIC MAMMALS	INGESTION
		EAST DITCH	AQUATIC PLANTS	CHEMICAL UPTAKE
			AQUATIC INVERTEBRATES	INGESTION DIRECT CONTACT
			AMPHIBIANS	INGESTION DIRECT CONTACT
			SEMI-AQUATIC BIRDS	INGESTION
			SEMI-AQUATIC MAMMALS	INGESTION

Prepared By / Date: MJM 02/24/09
Checked By / Date: SEH 02/24/09

[1] Assumes that inhalation and dermal exposure pathways are not significant or are incomplete.

Table 3.2-1
Objectives Table

Remedial Investigation/Feasibility Study Work Plan
Olin Chemical Superfund Site
Wilmington, MA

	OBJECTIVES LISTED IN STATEMENT OF WORK (SOW)	PROPOSED INVESTIGATIONS AND HISTORICAL INFORMATION TO ACHIEVE RI/FS OBJECTIVE
I.	**REMEDIAL INVESTIGATION OBJECTIVES**	
1	nature and extent of hazardous substance source areas	Historical sampling has been conducted for soil, groundwater, surface water, and sediment associated with the site. In the 1993, CSA report, Conestoga Rovers identified 34 SWMUs for further investigation; investigations were conducted between 1993 and 1997. Historical sampling efforts and aerial photographs have been used to establish Olin's understanding of the physical CSM. Additional sampling is proposed for each medium in all areas of the site as described in the FSP and associated tables and figures to further understand nature and extent of contamination associated with the site. (FSP, Sections 4.0, 5.0, and 6.0).
2	lateral and vertical extent, concentration, environmental fate, transport (e.g., bioaccumulation, persistence, mobility), phase (e.g., solid, liquid), and other physical and chemical characteristics of hazardous substances identified at the Site	The physical and chemical characteristics of the hazardous substances will be described in the RI based on literature information. The RI data collection efforts will produce data characterizing lateral and vertical extent of hazardous substances in soil, surface water, sediment, groundwater, and, potentially, air. The fate and transport of hazardous substances will be discussed using literature information and the nature and extent information collected in the RI, and that information previously discussed in Section 5.0 of the Draft FRI. The RI report will contain a separate section summarizing the fate and transport of contaminants.
3	the media of occurrence, interface zones between media, and important parameters for treatment (e.g., soil chemistry, soil types, estimated porosity)	The fate and transport of constituents at the Site is presented in Section 5 of the Draft FRI. This discussion relates chemical and media properties and cross media transport (e.g., from DAPL to groundwater, groundwater to surface water). The medium of occurrence associated with the vapor intrusion pathway is the air, directly influenced by the water table, through the capillary fringe into the vadose zone. Impacted groundwater to surface water in surface water in the South Ditch and East Ditch. The physical CSM is outlined in Volume I of the RI/FS Work Plan. Soils have been sufficiently studied to delineate soil types and estimate soil porosity and other relevant parameters affecting transport.
4	hydrogeologic factors for overburden and bedrock (e.g., depth to water table and water table fluctuations, hydraulic gradients, hydraulic conductivity, estimated porosity, and estimated recharge)	The depth to water table and extent of seasonal water table fluctuation has been studied and documented Site wide. Additional synoptic water levels are being collected to unify the current understanding of vertical and horizontal gradients across the Site. Recharge has been estimated and hydraulic conductivity, and media porosity estimated, in a manner sufficient to calibrate a detailed groundwater flow and solute transport model (FEFLOW) which was presented in Appendix A of the Draft FRI.
5	the delineation of any contaminant plume present and monitoring information that allows assessment of the spatial stability of constituent concentrations over time	The delineation of groundwater impacts will be adjusted as necessary when additional groundwater samples have been collected and analyzed. (FSP, Sections 6.2, 6.4). A statistical assessment was conducted and presented in Appendix E of the Draft FRI that describes indicator parameters' trends as a measure of stability of the groundwater constituent concentrations over time. That assessment would be updated, and new data compared to older data for detected VOCs, SVOCs, metals, and inorganics constituents in the RI report.

Table 3.2-1
Objectives Table

Remedial Investigation/Feasibility Study Work Plan
Olin Chemical Superfund Site
Wilmington, MA

	OBJECTIVES LISTED IN STATEMENT OF WORK (SOW)	PROPOSED INVESTIGATIONS AND HISTORICAL INFORMATION TO ACHIEVE RI/FS OBJECTIVE
6	identification of chemical, physical, and biological processes that may work to limit the continued transport, diminish the concentration, or otherwise attenuate contamination. Identification of the degree to which these processes can be expected to provide adequate natural attenuation and how these processes may be enhanced	The fate and transport is described in detail in Section 5 of the Draft FRI. The section includes discussions on contaminant persistence in the environment, biological and chemical processes that degrade or attenuate the concentrations of specific compounds. Additional chemical, physical and biological processes will be described in detail in the risk assessments, as necessary. The fate and transport discussion will be updated in the RI report. Assessment of processes to enhance natural attenuation will be discussed in the FS, as applicable.
7	climate and water table fluctuation (e.g., precipitation, run-off, stream flow, water budget)	Precipitation measurements are on-going by Olin personnel at the site. Stream gauging will be conducted as part of the FSP (FSP, Section 5.3) and groundwater elevations have been collected as part of the IRSWP and will continue to be collected under the RI (FSP, 6.3).
8	extent to which the hazardous substances have migrated or are expected to migrate from their original location, and identify probable receptor areas	Please see response to Remedial Objective 2 regarding the nature and extent of hazardous substances including migration and potential migration. Probable human health receptor areas include the manufacturing area (as subdivided by USEPA), the area north of and including the South Ditch, the area south of the South Ditch (not including the CSL), and surface soil in the containment area. Terrestrial ecological receptor areas include the Central Pond Wetland and Ephemeral drainage areas. Aquatic ecological receptor areas consist of the Upper & Lower South Ditch, Central Pond Wetland, on-PWD wetland, off-PWD, and East Ditch.
9	extent to which buildings, foundations, or other underground structures may contain or may overlie hazardous substances or contaminant plumes and the potential for vapor intrusion from the contaminant plume (this evaluation shall include existing and proposed structures)	An assessment of potential vapor migration at on-Property and off-Property locations will be conducted as described in the OU1 and OU3 sections of the FSP in the RI/FS Work Plan.

Table 3.2-1
Objectives Table

Remedial Investigation/Feasibility Study Work Plan
Olin Chemical Superfund Site
Wilmington, MA

	OBJECTIVES LISTED IN STATEMENT OF WORK (SOW)	PROPOSED INVESTIGATIONS AND HISTORICAL INFORMATION TO ACHIEVE RI/FS OBJECTIVE
10	contaminant(s) concentration in soil, sediment, surface water and groundwater, and potential impacts to aquatic, semi-aquatic and terrestrial receptors, and potential for higher trophic level organisms in the food web to be exposed	All available historical information and nature and extent data will be used to update the understanding of contaminant concentrations in all media. The RI report will contain a section detailing contaminant concentrations found in all media. Potential impacts to ecological receptors have been evaluated in numerous historical risk assessments, as discussed in Appendix F of the Draft FRI. Potential impacts to aquatic receptors (including amphibians) had existed in the South Ditch and in the on- and off-PWD due to contaminant concentrations in surface water; sediments from the on-PWD and the Upper South Ditch were remediated to address these concerns. Geochemical analysis indicated that the metal components of floc have low solubilities at the pH values occurring onsite, and are therefore not bioavailable to aquatic receptors. Potential impacts to aquatic, semi-aquatic, and terrestrial receptors will be further evaluated in the ERA as part of the RI. Biological tissue sampling (including tissue from small mammals, herbaceous plants, benthic macroinvertebrates, and amphibians), earthworm bioaccumulation studies, and food chain modeling evaluated the bioavailability of contaminants and the potential impact to higher trophic level receptors, including aquatic receptors (green heron), terrestrial birds (woodcock) and terrestrial mammals (red fox) (as summarized in Section 6.2 of the Draft FRI). Food chain model hazard quotients for higher trophic level receptors were below 1, indicating that there is limited to no potential for higher trophic level organisms in the food web to be exposed to Site contaminants. Food chain models in the RI ERA will further evaluate potential impacts to higher trophic level organisms.
11	flood plain and wetland delineation, if necessary, surface water classifications and their existing use designations	In Sept. 2004, BSC Group revised delineation of the wetland resource area. The extent of 100-yr and 500-yr flood zones are designated in EDR, which shows the MMBW area in the 100-yr flood zone and the southern portion of the Property in the 500-yr flood zone. Aberjona River is a class B surface water body according to the EDR. Most of the Ipswich River is designated as a Class B surface water body except for public water supply reservoirs and tributaries which are Class A surface water bodies. The RI report will contain a section discussing the flood plain and wetland delineation and surface water classifications.
12	groundwater characteristics and current and potential groundwater uses (e.g., characteristics related to the groundwater classes described in the Ground Water Protection Strategy, (EPA, 1984) and under Massachusetts law)	MA groundwater classification has been outlined in Section 3.6.3 of the Draft FRI. The Draft FRI also discussed past groundwater uses as well as current groundwater uses. Any additional evaluation of groundwater classes pertinent to the USEPA Groundwater Protection Strategy and future potential uses will be developed as part of the RI and HHRA documents.
13	waste characteristics that affect the type of treatment possible (e.g., BTU values, pH, BOD)	Soil and sediment removed in past removal actions contained chromium and was disposed off-site at facilities permitted to receive such materials. Treatment of DAPL has also been studied by vendors who were contacted to provide proposal for treatment and disposal of the DAPL for the DAPL Extraction Pilot Test. These material have been appropriately studied to allow assessment in a FS.

Table 3.2-1
Objectives Table

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	OBJECTIVES LISTED IN STATEMENT OF WORK (SOW)	PROPOSED INVESTIGATIONS AND HISTORICAL INFORMATION TO ACHIEVE RI/FS OBJECTIVE
14	potential extent and risk of future releases of substances or residuals remaining on-site and off-site	Available historical information have been reviewed regarding the potential for future releases. The two remaining known source areas are DAPL and LNAPL in the Plant B area. The site is no longer an active site, and therefore, there is no expected potential for future releases from these two source areas. The RI will include this information in the Site Background section.
15	physical characteristics of the Site, including important surface features, soils, geology, hydrogeology, meteorology, and ecology	The physical characteristics of the Site will be described in the RI based on historical aerial photographs, historical information included in previously submitted reports, and any updated data that are collected as part of the RI/FS process.
16	characteristics or classifications of air, surface water, and groundwater	Such classification will be incorporated from existing information contained in the Draft FRI and MCP designations. Classifications will be updated as appropriate for the RI/FS.
17	location of public and private water wells	Location of public and private water wells have been identified in the Draft FRI and in subsequent searches with the Town of Wilmington when private wells were sampled in 2008/2009 to identify currently active or abandoned private wells. The RI will include a section (with a figure and table) to show the most up-to-date information.
18	extent to which contamination levels exceed appropriate health-based levels	Contaminant concentrations will be compared to health-based levels as part of the BHHRA upon completion of RI activities.
19	extent to which substances at the Site may be reused or recycled	The wastes at the Site include principally VOCs, SVOCs, metals, and other inorganics and organic chemicals. The substances present are not generally amenable to re-use. During the RI/FS, if soil excavation and disposal alternatives are developed, alternatives to disposal such a asphalt batching will be considered and evaluated.
20	potential future risk posed by substances remaining onsite	The potential future risk will be addressed in the BHHRA and BERA upon completion of RI activities.
21	general characteristics of the waste, including quantities, type, phase, concentration, toxicity, propensity to bioaccumulate, persistence, and mobility	Waste quantities (DAPL) have been quantified and presented in the Draft FRI. The fate and transport and general characteristics of the contaminants was presented in Section 5 of the Draft FRI and in the Phase II Supplemental Investigation Report (Smith, 1997). The propensity of constituents to bioaccumulation will be discussed in the BHHRA and BERA.
22	extent to which the source areas can be adequately identified and characterized	Source areas have been adequately identified and characterized. The two remaining known source areas are DAPL and LNAPL in the Plant B area. Source areas were discussed in the Draft FRI, and the RI report will contain a section discussing source areas associated with the Site. Additional soil data will be collected from the former Facility to evaluate if additional sources are present.
23	actual and potential exposure pathways through environmental media	Exposure pathways are presented on the Draft CSMs in the RI/FS Work plan. Upon completion of RI activities, the CSM will be revised based on any additional information obtained.
24	actual and potential exposure routes (for example, inhalation and ingestion)	Exposure routes are presented on the Draft CSMs in the RI/FS Work plan. Upon completion of RI activities, the CSM will be revised based on any additional information obtained.
25	other factors, such as sensitive populations, that pertain to the characterization of the Site or support the analysis of potential remedial action alternatives	The identification of sensitive populations, as applicable, will be evaluated as part of the BHHRA and the BERA upon completion of RI activities.

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26	identification of potential additional source areas at both on- and off-Property locations	Source areas have been adequately identified and characterized. The two remaining known source areas are DAPL and LNAPL in the Plant B area. Source areas were discussed in the Draft FRI, and the RI report will contain a section discussing source areas associated with the Site.
II.	**SOIL AND SOURCES OF CONTAMINANTS OBJECTIVES**	
1	the nature and concentration of contaminants in the surface soils (0-6 inches), and subsurface soils (6-inches to 10 feet below ground surface or to four feet below waste or contaminated soils, whichever one is greater) over the entire Site, and focused on areas expected to have been impacted by Site contamination	In the FSP, surface soil will be defined as 0-1 foot bgs and subsurface soil will be defined as 1-10 feet bgs. Samples deeper than 10 feet bgs at a minum of 6 locations with additional samples possible depending on sampling results from the 1-10 foot interval. Proposed sampling locations were selected to obtain coverage of the entire Site and to evaluate areas with known historical activities. The RI will evaluate historical surface and subsurface soil sampling data, as well as, soil sampling data collected as part of the RI/FS process, to determine the nature and concentration of contaminants in soil.
2	the phase in which the contaminants exist, whether as free products (NAPL), dense liquids (DAPL or diffuse layer) or chemical complexes (e.g., dissolved in groundwater, adsorbed by grains)	The physical and chemical characteristics of the hazardous substances will be described in the RI based on literature information. Contaminants will be identified in the RI report by media in which detected, including soil, surface water, sediment, groundwater and DAPL.
3	the physical parameters for each soil type and layer that is contaminated (e.g., soil moisture, soil profile, soil type, density, porosity (estimated), grain size, distribution, total organic carbon, mineralogy). This information may be reported on charts, maps, and cross sections	The physical parameters necessary for identification and evaluation of contaminated soils requiring remedial action are known and will be reported in the FS based on historical information and investigations proposed for OU1 in the RI/FS Work Plan.
4	the waste characteristics and mixtures that affect the type of treatment possible (pertinent physical and chemical characteristics of each compound may be reported in a chart)	Waste characteristics will be assessed after sampling conducted as part of the RI/FS. DAPL and LNAPL have been characterized. Recovery of LNAPL has been ongoing since 1981 and enhanced remediation (including AS/SVE) began in 2000. LNAPL has been discussed in detail in the IRSWP-Plant B. DAPL has been discussed in Section 2 of the Draft FRI and has been studied extensively. DAPL will be described in more detail in the RI/FS Work Plan based on historical studies of the material.
5	the extent to which the contaminants may be reused and/or recycled	The wastes at the Site include principally VOCs, SVOCs, metals, and other inorganics and organic chemicals. The materials present are not generally amenable to re-use. During the RI/FS, if soil excavation and disposal alternatives are developed, alternatives to disposal such a asphalt batching will be considered and evaluated.
6	the background concentrations for all naturally occurring contaminants, to be obtained from soils at the relevant OU unless EPA determines (on its own initiative or in response to a proposal by Respondents) that it is necessary to derive background concentrations from other soils	The site is on a groundwater divide and therefore upgradient groundwater for use as background is not available. Background groundwater concentrations used for Industri-plex were presented in the Draft FRI and are being considered for OU3. Background soil concentrations from the 1997 Supplemental Phase II and MA background are currently proposed for OU1 soils. Background surface water and sediment data were collected historically and will be updated by resampling for OU1 and OU2.

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	OBJECTIVES LISTED IN STATEMENT OF WORK (SOW)	PROPOSED INVESTIGATIONS AND HISTORICAL INFORMATION TO ACHIEVE RI/FS OBJECTIVE
7	the physical limitations and other materials handling aspects of the soil and other sources that are contaminated	Contaminated soils that have been removed historically under the MCP have been fine to medium sands and gravels and have not posed material handling limitations, either from physical properties or fugitive emissions. The material handling issues associated with DAPL removal will be evaluated in the DAPL Extraction Pilot. DAPL is a hazardous material based on chromium content; it is acidic, corrosive and prone to precipitation of acid sulfates and iron minerals.
8	the estimated volumes of soils and other sources of contamination	The volume estimates of DAPL have been completed and were discussed in the Draft FRI in Section 4.3.1.1. Volumes estimates of contaminated soil requiring evaluation in an FS will be developed based on results of soil investigations performed under OU1. Volumes estimates of contaminated sediment requiring evaluation in an FS will be developed based on results of sediment investigations performed under OU1 and OU2.
9	the ecological setting of the sampled location including types of vegetation present, depth to water table, local water flow regimes and any anthropogenic alterations	The ecological setting was discussed in detail in the Draft FRI. The flow and flow regimes of surface water in the South Ditch have been studied by installation of flumes and weirs and were presented in the Draft FRI. Flow measurements within MMB and Saw Mill Brook will be conducted monthly during the RI under OU2 to obtain water balances for that portion of the watershed. Depth to water table is well known over the entire Site from historical installation and monitoring of an extensive groundwater monitoring well network.
III.	**SUBSURFACE AND HYDROGEOLOGICAL INVESTIGATIONS OBJECTIVES**	
1	the nature and extent of contamination (lateral and vertical, in each hydrologic unit) sufficiently to define the boundaries of contaminant plumes located on the Site and to characterize the aquifers in three dimensions, including bedrock	Historical data has been used to develop estimates on the extent of groundwater impact in both overburden and bedrock groundwater systems. Overburden is a series of glacial outwash deposits underlain by a thin veneer of till and which, collectively, can be considered one hydrostratigraphic unit. The bedrock is a metamorphosed sequence of mylonites intruded by granitic and gabbroic bodies. The bedrock lithology may be treated as one hydrologic unit, distinct from overburden. This historical data is being updated by two extensive rounds of groundwater sampling of both overburden and bedrock wells. Additional wells are being installed based on discussions with USEPA. The data will be sufficient of assessment of the extent of groundwater impacts in three dimensions and assessment of any unresolved data uncertainties or gaps.
2	populations and environments at risk and potential risks associated with future releases, if applicable	The environmental and demographic setting surrounding the Site was discussed and presented in Section 3 of the Draft FRI. The potential migration pathways for human and ecological receptors has been studied in a series of human health and ecological assessments conducted under the MCP and presented in Section 6.0 of the Draft FRI. The CSMs for human health and ecological exposure routes are also presented in Volume I of the RI/FS Work Plan. The facility has been closed for several decades, and these are no activities that would result in a future release. The DAPL pools reside within in bedrock depressions and have been monitored annually for the past decade.

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3	an estimate of the number of years necessary to achieve clean-up goals for groundwater alternatives, including extraction and treatment remedial alternatives	A finite element groundwater flow and solute transport model (FEFLOW) has been implemented at the Site and may be utilized to aid the assessment of clean up time frames for groundwater. The most recent update of the model was presented in Appendix A of the Draft FRI. Column studies to simulate extraction of DAPL have also been completed and have related solute changes and mass removal to the pore volumes of DAPL extracted and displaced. These data and tools are available to assist development of reasonable and realistic clean up time frame estimates in the FS.
4	the subsurface stratigraphy, structure and properties for each hydrologic unit. The following may be included in this analysis: thickness, lithology, grain size distribution (glacial deposits), soil index properties (e.g. plasticity index), porosity, hydraulic conductivity, fraction of organic carbon, storativity, sorting, fracturing (orientation, frequency), and moisture content. Depending on initial screening results, other properties may be evaluated as warranted by data requirements of potential remedies or fate and transport evaluation	The subsurface stratigraphy at the site has been presented in a series of detailed cross sections of the glacial deposits within the MMBA and on-Property areas. The material is dominated by fine to medium sands with coarser sand and gravels, and some silty sands. The material is the result of transgression and recession of ice sheets during the last glaciation, and development of associated ice contact and outwash deposits. This material is underlain by a thin veneer of dense basal till that mantles bedrock. The sands and gravels are non-plastic, and their hydraulic properties have been extensively studied in support of development of the FEFLOW model (see Appendix A of the Draft FRI for compilation of hydraulic conductivity test results for overburden and bedrock wells, and estimates of storativity, transmissivity, and porosity for overburden system. Organic carbon (foc) data have been collected in previous investigations. The bedrock has been extensively cored and evaluated by thin section analysis to determine geologic relationships at the Site. Fracture assessments have also been conducted by surface mapping and borehole geophysical studies. Additional borehole geophysics and seismic studies are planned for the OU3 RI. Extensive seismic studies have been conducted to evaluate the bedrock surface and contribute to the understanding of the structural geologic setting of the Site. Site specific data correlates well with published geologic studies of the region.
5	the concentration, transport mechanisms, potential receptor locations, and other significant characteristics of each contaminant	Concentrations of all detected chemicals were presented in the Draft FRI. Fate and transport of Site-related contaminants is discussed in Section 5 of Draft FRI. Potential receptor locations and any additional characteristics will be further described in the risk assessments. Any additional chemical of potential concerns that are identified as a result of the RI/FS activities will be researched to document fate and transport characteristics.
6	the waste mixtures and partitioning of contaminants between groundwater and soil or rock, and whether NAPL is present	The nature of the contaminants present have been well studied with respect to their transport characteristic. To the extent required, partitioning calculations of contaminants between sources, soils and groundwater can be completed in the RI/FS using published literature values, and reasonable estimated ranges for such values when unavailable. Precipitation mechanisms have been documented to be important and the mineral composition of the precipitates have been studies, as well as the solubility of some of the precipitates when exposed in the environment (e.g., floc). Additional media or material specific studies are not required at this time. NAPL is present at Plant B and its extent is known.
7	the waste mixtures and partitioning of contaminants between the shallow groundwater, diffuse layer and dense aqueous-phase layer (DAPL)	Site specific diffusion coefficients were established for principal constituents in DAPL, diffuse and overlying groundwater and are discussed in the Supplemental Phase II Investigation Report (Smith, 1997).

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8	the extent of, and character and controls of the migration of, any NAPL or DAPL	LNAPL (Plant B) is currently contained by a groundwater extraction system. Currently, the DAPL material remains in isolated bedrock depressions (the Upper DAPL pool , the Main Street pool, and the area of GW-83D) and is no longer migrating horizontally by gravity-driven migration.
9	a quantification of the hydrogeological factors (e.g., in-situ hydraulic conductivity, storativity, conductivity, and storage capacity of each hydrologic unit; aquifer thickness; hydraulic and pressure gradients; and degree of interconnection between the different hydrogeologic units (e.g., bedrock and specific overburden strata)	The implementation of the FEFLOW groundwater flow and solute transport model presented in Appendix A of the Draft FRI compiled the hydrologic properties of the overburden and bedrock groundwater systems. Additional study of bedrock and overburden groundwater is being conducted for OU3 and is described in Section 6 of the FSP in the RI/FS Work Plan.
10	the routes of groundwater migration, transport rates, and potential receptors. Also determine or qualitatively describe the locations, flow rates, contaminant concentrations, variability for discharge to bodies of surface water and wetlands, and head distributions within the geohydrologic units	Hydrologic and chemical data collected under the RI/FS Work Plan, for OU2 and OU3, in conjunction with prior data discussed in Sections 2, 3, 4 and Appendix A of the Draft FRI will be developed and assessed in the RI reports to address these topics.
11	depth to and seasonal fluctuations in the water table, flow gradients, and contaminant concentrations, simultaneously with other factors such as precipitation, run-off, and stream flow	These data exist from historical studies and are being comprehensively re-assessed by data collected under OU2 and OU3 in the RI/FS Work Plan.
12	the condition of any existing monitoring wells and the need to replace or abandon them (utilizing data from any previous investigations)	Data will be collected during sampling and monitoring activities.
13	the construction location, and proximity, of residential, municipal, and previously installed monitoring wells, if available	These data have been compiled and presented to USEPA previously (Olin Well Logs).
14	an assessment of plume stability and the migration potential of hazardous substances (analytical and/or numerical models and a process for modeling should be identified. The parameters, assumptions, accuracy, contingencies of the studies must be explicitly stated, and a plan established to verify the modeling if a significant risk is indicated for a specific population or environment)	If required, the statistical assessments and groundwater modeling preseneted in the Draft Focused RI will be updated/completed in the RI Report based on newly acquired chemical data.
15	a review and illustration of groundwater classifications (the need for institutional controls on ground-water use, considering such controls as adjuncts to remedial action, must be assessed)	MCP groundwater classifications were presented and discussed in the Draft FRI and will be updated in the RI/FS reports based on the results of new proposed groundwater investigations, the BHHRA, and the FS. Institutional controls will be evaluated in the FS.
16	physical and chemical characteristics that may affect the possible type of treatment (this information must be reported in a chart)	This information has been previously discussed under prior objectives. These data will be updated and presented in the FS.
17	the background concentrations of naturally occurring contaminants in groundwater at a sufficient number of horizontal and vertical locations at the relevant OU (including at least one for the saturated unconsolidated overburden and bedrock), unless EPA determines (either on its own initiative or in response to a proposal by Respondents) that it is necessary to derive background concentrations from other areas	OU3 does not have an upgradient location due to the presence of a groundwater divide that bisects the Site. Alternative approaches have been proposed to USEPA and will warrant continued discussion.

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18	engineering properties of soils and wastes for settlement and slope stability analyses if capping is considered	This information would be completed as a predesign investigation, if required, and would not be required to complete a RI/FS for the Site given the types of soil present.
IV.	**AIR QUALITY ASSESSMENT OBJECTIVES**	
1	identification of any likely or detected point and area emissions of particulate, volatiles, and semi-volatiles for the existing Site, including volatilization from soil, leachate, contaminated water, landfills, waste piles, and other contaminant areas	The Conceptual Site Model for the Site suggests that there may be potential for a complete vapor intrusion pathway associated with volatile compounds in the subsurface under current and potential future land uses at the former Facility and the surrounding areas. On-Property and off-Property investigations into the vapor intrusion pathway will be completed to determine if the pathway is potentially significant. Groundwater samples will be collected from the monitoring wells identified as representing shallow groundwater or being downgradient of the Property, to support the Tier I vapor intrusion investigation; these samples will be analyzed for VOCs and SVOCs. For samples with one or more compounds with concentrations above the updated Table 2c of the USEPA's Vapor Intrusion Guidance of 2002 screening values (values from the table will be updated by Olin if toxicity values have changed since 2002 and the risk-based concentrations calculated by USEPA Region 1 (2002) will replace the MCL-based values that are in the 2002 table), additional vapor intrusion investigation will be proposed.

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2	identification of any existing or planned structures, or areas where potential structures could be built, located above the plume area where intrusion of vapor may result in a potential unacceptable inhalation risk. The Respondents shall use the Johnson and Ettinger Model for Subsurface Vapor Intrusion into Buildings as required by EPA's Draft Guidance for Evaluating Vapor Intrusion from Groundwater and Soil (Nov. 2002), or any revisions to such, to support this assessment	The nature and extent of VOCs and the more volatile SVOCs in shallow overburden groundwater will be characterized by groundwater sampling and analysis at the monitoring well locations discussed below during the Tier I Investigation of the potential vapor intrusion pathway. The proposed sampling locations provide spatial coverage of the areas on-Property where occupied structures could be placed. There is currently one on-ground occupied structure at the Property – the Plant B groundwater treatment building. The remaining buildings at the former Facility are not occupied, and the buildings that housed the former offices, laboratories, maintenance area, and pilot plant are not currently serviced by electricity. The proposed sampling locations also provide spatial coverage of areas adjacent to the Property where occupied structures exist or could reasonably be expected. The proposed sampling and analysis program has been designed to characterize nature and extent of "volatile" compounds in shallow groundwater at the Property and in nearby "downgradient" areas. Occupied buildings at the former facility and in the surrounding area have been identified. The identification of occupied buildings is not an identification of impacted buildings. The portion of the former Facility located to the north of the South Ditch (excluding the containment area, the identified wetlands, storm water retention basin, and the Central Pond) is considered a potential redevelopment area and it will be assumed in this investigation that occupied buildings could be constructed within that area in the future. There are currently occupied industrial/commercial buildings in the proximity of the Site located on Eames Street, Jewel Drive, Main Street (primarily the eastern side of the street), Woburn Street, New Boston Street and Breed Avenue. There are current residences in the proximity of the Site located at the eastern end of Eames Street, along the western side of Main Street, on Cook Avenue, and Border Avenue. The Johnson and Ettinger Model for Subsurface Vapor Intrusion into Buildings will be used to evaluate the vapor intrusion pathway in the BHHRA.
3	provision for monitoring concentrations (before or after any intrusive field work performed during non-summer months) at a sufficient number of locations	Air monitoring of the work environment will be undertaken during soil sampling activities to ensure that the PPE and engineering controls utilized at the Site are sufficient to ensure worker safety. When drilling indoors, the level of carbon monoxide and oxygen and potential for explosive atmospheric environments will be monitored continuously with an O_2/LEL meter. Although the tasks and methods used in soil sampling are not expected to create an airborne dust issue, MACTEC anticipates using water spray methods during intrusive activities to reduce the potential for airborne dust, if needed. However, whenever the Subcontractor is drilling into and through concrete, wet methods of drilling must be implemented to prevent airborne dust. In the event that soil conditions have the potential to cause airborne dust, the Site Health and Safety officer or Field Operations Leader will notify the MACTEC PM and Project ES&H officer and determine if dust monitoring is necessary.

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4	characterization of emissions as indicated above (i.e., particulate, vapors, precipitates, and gases)	The nature and extent of VOCs and the more volatile SVOCs in shallow overburden groundwater and unsaturated zone soil will be characterized by groundwater and soil sampling and analysis. At a minimum, air monitoring during soil sampling activities will include evaluations for hazardous concentrations of airborne VOCs using a PID and benzene colorimetric detector tubes. When drilling indoors, the level of carbon monoxide and oxygen and potential for explosive atmospheric environments will be monitored continuously with an O2/LEL meter.
5	estimation of the emission rates and worst case impacts on and off-site for the existing Site (detailed techniques for the characterizing of air emissions and impacts shall be used if screening data indicate a potentially significant concentration)	The results of the Health & Safety air monitoring program will be used to determine if there is a need to do further evaluation of air emissions. If so, a scope of work will be proposed to USEPA for approval.
6	supplementation of ambient air monitoring with the collection of on-site meteorological data including ambient temperature, wind speed, wind direction, and barometric pressure, if necessary	Weather conditions, including the prevailing wind direction, will be observed and recorded for each day of Site activities.
7	provision for monitoring of ambient air quality as described in the Work Plan that shall include a description of (a) the sampling methodology (including instrumentation, sampling times, locations, detection limits, QA/QC procedures) and (b) the analytical methodology including instrumentation, detection limits and QA/QC procedures	To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct reading instrumentation. Information gathered will be used to ensure the adequacy of the levels of protection being used at the Site, and may be used as the basis for continuing or stopping work. Air monitoring equipment to be used on Site includes a PID, benzene colorimetric detector tubes, and a oxygen, LEL, and carbon monoxide meter to detect these gases during indoor drilling.
8	provision for modeling for potential emission sources (if necessary), including documentation of (a) source characteristics (e.g., emission rates, release height, velocity, temperature, source configuration, etc.), (b) meteorological conditions, (c) receptor locations, and (d) background concentrations at the relevant OU, unless EPA determines (on its own initiative or in response to a proposal by Respondents) that it is necessary to derive background concentrations from other areas	The results of the Health & Safety air monitoring program will be used to determine if there is a need to do further evaluation of air emissions. If so, a scope of work will be proposed to USEPA for approval.
9	evaluation of the factors that are critical in characterizing the nature and extent of airborne contaminants from the Site, if any, such as background air quality	The factors that are critical in characterizing the nature and extent of airborne contaminants include: emissions rates, release height, velocity, temperature, source configuration, meteorological conditions, receptor locations, and background concentrations. The results of the Health & Safety air monitoring program will be used to consider if there is a need to do further evaluation of air emissions. If so, a scope of work will be proposed to USEPA for approval.

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V.	**SURFACE WATER AND SEDIMENTS OBJECTIVES**	
1	the nature and extent of surface waters and sediments sufficient to define impacted locations and quantity of contaminants	The RI will evaluate historical surface water and sediment sampling data, as well as, surface water and sediment sampling data collected as part of the RI/FS process, to determine the nature and concentration of contaminants in surface water and sediment.
2	populations and environments at risk and potential risks associated with continued exposure	The Physical and Human Health CSM (Figure 2.0-4), the Ecological CSM - OU1 Terrestrial Areas (Figure 2.0-5) and the Ecological CSM - OU1/OU2 Aquatic Areas (Figure 2.0-6) illustrate receptors potentially at risk in the RI/FS Work Plan. The physical CSM illustrates how contaminants move from source areas to media and potential risk populations. The Human Health CSM illustrates risk populations by operable unit, medium and investigational area. The Ecological CSMs illustrate how contaminants move from media through ecological food chain pathways of at risk populations. Terrestrial environments at risk include the Central Pond Wetland and Ephemeral drainage areas. The aquatic environments at risk include the Upper & Lower South Ditch, Central Pond Wetland, on-PWD wetland, off-PWD, and East Ditch. Receptors & potential risks associated with continued exposure will be further evaluated in the BHHRA and BERA as part of the RI.
3	an estimate of the amount of flow, including seasonal variations, and the destination of those surface waters	Monthly stream gauging is being conducted under OU2 in the RI/FS Work Plan appropriate to meet this objective. The surface water system is known from previous investigations.
4	the concentration, transport mechanisms, potential receptor locations, and other significant characteristics of each contaminant in surface water and sediment	Historical surface water and sediment data were discussed in the Draft FRI (Sections 4.1.3, 4.1.4, 4.2.1, and 4.2.2) and are listed with the analytical data in Appendix C of the Draft FRI. Additional surface water and sediment samples will be collected as part of the RI activities. Concentrations of each contaminant will be summarized in the RI, incorporating relevant historical and current data. Transport mechanisms are defined in Figures 2.0-4 (Physical and Human Health Site CSM), 2.0-5 (Ecological CSM - OU1 Terrestrial Areas), and 2.0-6 (Ecological CSM - OU1/OU2 Aquatic Areas) of the RI/FS Work Plan. As shown in the Ecological CSMs, terrestrial ecological receptor areas include the Central Pond Wetland and Ephemeral drainage areas. Aquatic ecological receptor areas include the Upper & Lower South Ditch, Central Pond Wetland, on-PWD wetland, off-PWD, and East Ditch. The physical and chemical characteristics of the hazardous substances will be described in the RI based on literature information.

Table 3.2-1
Objectives Table

Remedial Investigation/Feasibility Study Work Plan
Olin Chemical Superfund Site
Wilmington, MA

	OBJECTIVES LISTED IN STATEMENT OF WORK (SOW)	PROPOSED INVESTIGATIONS AND HISTORICAL INFORMATION TO ACHIEVE RI/FS OBJECTIVE
5	a review and illustration of surface water classifications (the need for institutional controls on exposure, considering such controls as adjuncts to remedial action, must be assessed)	Aberjona River is a class B surface water body according to the EDR. Most of the Ipswich River is designated as a Class B surface water body except for public water supply reservoirs and tributaries which are Class A surface water bodies.
6	physical and chemical characteristics that may affect the possible type of treatment (this information must be reported in a chart)	This information will be compiled and additional literature review conducted in the RI report for use and presentation in the FS.
VI.	**RISK ASSESSMENT OBJECTIVES**	
1	to characterize, and quantify where appropriate, the current and potential human health and environmental risks that would prevail if no further remedial action is taken	The potential future risk will be addressed in the BHHRA and BERA upon completion of RI activities.
VII.	**ECOLOGICAL ASSESSMENT OBJECTIVES**	
1	an accurate delineation of the wetland boundary using the U.S. ACE, 1987, Wetlands Delineation Manual with N.E. Division Field Data Collection Sheets, and classification of the wetland types using the Classification of Wetlands and Deepwater Habitats of the United States (FWS/OBS-79/3I, US Fish and Wildlife Service, 1979) and determination of the functions and values of the wetlands and an accurate description and delineation of the ten (10) year and hundred (100) year floodplain	On- and off-Property wetlands have been delineated since 1992 to support multiple wetland NOIs filed under the Massachusetts Wetland Protection Act regulations. The most recent wetland delineations, conducted in 2003 and 2004 by BSC Group, delineated all on-property wetlands, the near-property boundaries of East Ditch, and the off-PWD along Jewel Drive. Wetland resource areas were delineated in accordance with MassDEP Policy 95-1 and with the US ACE Wetland Delineation Manual. On- and off-Property wetlands have also been classified following FWS/OBS-79/31 as indicated on National Wetland Inventory Maps. The Upper South Ditch is classified as a palustrine emergent/persistent system that has a seasonally flooded/saturated water regime. The Central Pond Wetland is classified as a palustrine forested/persistent system that has a seasonally flooded/saturated water regime. 100-yr and 500-yr floodplains are available from Flood Insurance Rate Maps. Wetland functions and values have been described in the various NOI reports filed to support Site activities. Wetlands functions and values were also discussed in historical ERAs summarized in Appendix F.2 (Historical Environmental Evaluations) of the Draft FRI to help identify meaningful assessment and measurement endpoints as per MassDEP ecological risk assessment guidance (MassDEP, 1996). Considered together, these assessments demonstrate that the on-property ditches, Central Pond, East Ditch, and MMB provide flood storage capacity, groundwater recharge/discharge benefits, and shoreline stabilization. On-property ditches, Central Pond, and East Ditch provide poor habitat value, wildlife habitat (including threatened and endangered species), recreation, educational and scientific value, aesthetics, and uniqueness. East Ditch provides poor function and value due to impacts associated with frequent railroad maintenance which has caused physical habitat degradation. MMB does provide more valuable functions. Wetland function and value will be further evaluated in the RI BERA.

Table 3.2-1
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Remedial Investigation/Feasibility Study Work Plan
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	OBJECTIVES LISTED IN STATEMENT OF WORK (SOW)	PROPOSED INVESTIGATIONS AND HISTORICAL INFORMATION TO ACHIEVE RI/FS OBJECTIVE
2	a description of habitat types including a map of major habitats present at the Site and a list of plant and animal species, both resident and transient	As described in Section 3.7 of the Draft FRI and as documented during Site inspections that have been performed weekly since 1997, the terrestrial habitat that is available to ecological receptors is made of upland forest, which consists of mixed stands of hardwoods and pines dominated by white pine (*Pinus strobus*), northern red oak (*Quercus rubra*), and white ash (*Fraxinus americana*). Terrestrial wildlife observed or likely to occur at the Site include eastern cottontail (*Sylvilagus floridanus*), woodchuck (*Marmota monax*), red fox (*Vulpes vulpes*), and birds such as American robin (*Turdus migratorius*), and American woodcock (*Scolopax minor*). The aquatic habitat associated with the Property consists primarily of a network of shallow-manmade ditches and a centrally located 0.2 acre pond. The pond and ditches do not support a diverse aquatic community. The ditches, which tend to go dry during summer months, are incapable of supporting a diverse aquatic community because they are generally of insufficient depth, temperature, and oxygen content to support populations of fish or sensitive benthic macroinvertebrates (e.g. mayflies, stoneflies), even in the absence of the existing contamination. The aquatic fauna associated with these aquatic habitats consist primarily of stress-tolerant taxa such as crayfish, dragonfly nymphs, amphipods, and midge larvae. Emergent vegetation, algae, and phytoplankton have also been observed in these areas. During the various site walkovers and habitat surveys conducted throughout the numerous investigations, no fish have been observed in the ditches and no evidence of stressed biota attributable to the facility have been noted. Potential aquatic and aquatic wildlife in the MMB and Sawmill Brook wetland complex include fish, amphibians, aquatic invertebrates, and aquatic plants. Further details on habitat types, a map of major habitats present, and lists of Site-related plant and animals species are included in Section 3.7 of the Draft FRI and in historical documents and will be re-evaluated in the ERA as part of the RI.
3	a determination of the status of those species identified in terms of sport or commercial usage. protected status, endangered, threatened, or of special concern	Descriptions of flora and fauna observed or likely to occur at on-Property and off-Property terrestrial and aquatic habitats associated with the Site have been reported in historical documents and in Section 3.7 of the Draft FRI Report. On-Property and off-Property water bodies are not commercial fisheries and terrestrial areas are not significant habitat for sport usage. Recreational hunting and fishing are not permitted onsite. As described in Section 3.7.3 of the Draft FRI Report, periodic consultations with the USFWS and the MNHESP as well as review of the Massachusetts Natural Heritage Atlas have not identified any priority habitat (including certified vernal pools) or listed species in the vicinity of on-Property and off-Property study areas. USFWS and MNHESP were contacted in 1993, 1997, 2002 and 2004. Although the Mystic Valley Amphipod (*Crangonyx aberrans*) has historically been reported as occurring in a wetland near the Halls Brook Drainage, this species was delisted by the MNHESP in 2004.

Table 3.2-1
Objectives Table

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	OBJECTIVES LISTED IN STATEMENT OF WORK (SOW)	PROPOSED INVESTIGATIONS AND HISTORICAL INFORMATION TO ACHIEVE RI/FS OBJECTIVE
4	sampling of environmental receptors for analysis of community composition, abundance, or body burden of contaminants	In addition to observations made during Site inspections that have been performed weekly since 1997, numerous events have been executed to inventory community composition and abundance at on-Property and off-Property study areas. As part of a Phase II Focused ERC, MACTEC conducted an aquatic macroinvertebrate community survey in the East Ditch, upstream and downstream of its confluence with the South Ditch. Study area and background locations were sampled using Level II RBPs. The results of the survey and biological diversity analysis indicated that the aquatic macroinvertebrate community in the East Ditch is characteristic of a degraded warmwater ditch and that there are no differences between the types or abundance of macroinvertebrates found throughout the ditch system. Furthermore, the survey concluded that there was no substantial risk of harm to the aquatic macroinvertebrate community in the East Ditch resulting from OHMPC released from the site. Included as part of the macroinvertebrate survey was a qualitative amphibian survey that documented the abundance of frogs found in the East Ditch. The amphibian survey results indicated that a viable frog population existed within the East Ditch system, and abundances observed at study area locations were greater than those at the reference location, supporting a conclusion of no significant risk of harm to amphibian populations in the East Ditch from exposure to site surface water and sediment. As stated in Section 6.2.1 of the Draft FRI, chemical concentrations in prey tissue were directly measured from biological specimens collected at the Site in October 1996 to support the 1997 Stage II ERC. Small mammals, herbaceous plants, benthic macroinvertebrates, and amphibians inhabiting the site were captured and sacrificed, and their tissue analyzed for OHMPC. Twenty-eight-day earthworm bioaccumulation studies were also conducted to support the 1997 Stage II ERC. Additional earthworm toxicity and bioaccumulation tests were conducted from floodplain area soil in 2005. The available tissue data are sufficient to support the BERAs. Based on several years of data, no Site-related impacts to surface water or sediment in the MMBW have been identified. No tissue data collection is proposed for the MMBW.
5	sampling of chemical and physical parameters for surface water and sediments (e.g., grain size, total organic carbon, dissolved oxygen, etc.)	As discussed in text and tables in Appendix F.2 (Historical Environmental Evaluations) of the Draft FRI, and as reported in historical documents, surface water and sediment have been sampled for chemical and physical parameters including hardness, pH, total organic carbon, chemical oxygen demand, and percent solids. Chemical and physical parameters for surface water and sediment will be evaluated in future sampling events as part of the RI.

Table 3.2-1
Objectives Table

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	OBJECTIVES LISTED IN STATEMENT OF WORK (SOW)	PROPOSED INVESTIGATIONS AND HISTORICAL INFORMATION TO ACHIEVE RI/FS OBJECTIVE
6	toxicity testing of indicator species, if required, to determine effects of contaminated Site media on the environment	As stated in Section 6.2.1 of the Draft FRI and as described in historical documents, earthworm (*Eisenia fetida*) and FETAX toxicity tests (ATSM, 1991) were performed as part of the 1997 Stage II ERC (Smith et al, 1997) that evaluated terrestrial and aquatic habitats at the Facility. Sediment and soil samples collected for the 1997 toxicity tests are shown in Figure 10 in the 1997 Stage II ERC. Impacts to earthworm mortality, growth, and health were assessed using a 14-day subchronic test at eight study area samples were interpreted to be negligible when compared to a reference sample and laboratory control. The FETAX test consisted of a 96-hour screening assay, followed by a FETAX definitive (dilution) test to derive LC-50, EC-50, IC-50, IC-25, and ANOEC that were used to develop concentration response curves. FETAX results demonstrated no significant mortality or malformations relative to the reference sample for the off-PWD, South Ditch, and Central Pond. Two samples from the on-PWD exhibited statistically significant mortality and malformation relative to reference. The on-PWD and Upper South Ditch were subsequently remediated. Earthworm toxicity tests and FETAX tests conducted in 2005 further evaluated the top six inches of floodplain soil and lower South Ditch sediment. Soil samples were collected from six floodplain area and three reference area locations. The earthworm toxicity test consisted of 28-day E. fetida tests for growth and survival. The test results suggested that the potential for significant population level effects on the terrestrial macroinvertebrate community was negligible. FETAX sediment samples were collected from three locations in the lower South Ditch. The FETAX test consisted of a 96-hour screening assay to assess tadpole survival, length, and malformations. Test results suggested that the potential for significant population level effects on the amphibian community was negligible. Toxicity tests using MMB surface water and sediment have not been determined to be necessary because site-related chemical impacts to surface water and sediment have not been detected. A 42-day chronic exposure *Hyalella azteca* whole sediment toxicity test for survival, growth, and reproduction will be performed in South Ditch as part of the RI. Sediment will be collected from the location with the highest HI based on existing data.

Table 3.2-1
Objectives Table

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	OBJECTIVES LISTED IN STATEMENT OF WORK (SOW)	PROPOSED INVESTIGATIONS AND HISTORICAL INFORMATION TO ACHIEVE RI/FS OBJECTIVE
7	an evaluation of how the contamination from the Site has affected the receptors, including a discussion of fate and transport of the contaminants to the various habitat types or organisms	As explained in Appendix F.2 of the Draft FRI and as described in historical documents, impacts from Site-related chemicals in surface water, sediment, soil, and biological tissue have been extensively evaluated and characterized throughout the ERA program using a number of measurement endpoints, including food chain modeling that used Site-specific measured tissue concentrations, toxicity tests, bioaccumulation studies, population modeling, benchmark comparisons, and community surveys. Investigations throughout the ERA program have concluded that for all exposure areas, receptors were not adversely affected except for the on- and off-PWD and the South Ditch. The sediments of the on-PWD and the Upper South Ditch were remediated to address these concerns. Historical surface water concentrations have not been consistent with ARARs, and will be investigated further as part of the RI. Fate and transport of contaminants to habitat and organisms is illustrated in the Physical and Human Health CSM (Figure 2.0-4) and the Ecological CSMs (Figures 2.0-5 and 2.0-6). The Physical CSM illustrates how contaminants move from source areas to media. The Ecological CSMs illustrate how contaminants from media move through ecological food chain pathways of at risk populations.
8	an evaluation of whether contamination has affected the health of the wetland and other major habitats present at the Site (e.g., reduced plant growth or vigor or contributed contaminants to the food web)	As discussed in Appendix F.2 of the Draft FRI and in historical documents, the ecological risk assessments that have performed to date have collectively concluded the following regarding whether contamination has affected major habitats present at the Site: • A condition of No Significant Risk of harm to the environment exists for the soil at the 51 Eames street Property (Smith et al, 1997); • There is negligible risk associated with sediments within most of the ditch systems, including the East Ditch and the New Boston Street Drainway (MACTEC, 2005b); • The lower South Ditch sediments require further risk evaluation (Smith et al, 1997); • The Site-specific risk assessments conducted to date have not documented significant impacts to aquatic life associated with surface water quality (Smith et al, 1997); and • No site-related impacts have been identified in MMBW surface water or sediment (MACTEC, 2002). These conclusions will be re-evaluated in the ERA as part of the RI.
9	a discussion of how each remedial alternative under consideration affects the wetland, biota, and their functions and values	Currently, there are no proposed remedial alternatives. If remedial alternatives are presented in the future, a discussion of how each alternative under consideration would affect the wetland, biota, and their functions and values would be conducted at that time.
VIII.	**FEASIBILITY STUDY OBJECTIVES**	
1	If remediation is determined to be necessary, the Respondents shall develop a range of alternatives through performance of a feasibility study, as described below, for the appropriate Operable Unit	The FS shall be developed in accordance with USEPA guidance as specified in the SOW.

Table 3.2-1
Objectives Table

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	OBJECTIVES LISTED IN STATEMENT OF WORK (SOW)	PROPOSED INVESTIGATIONS AND HISTORICAL INFORMATION TO ACHIEVE RI/FS OBJECTIVE
IX.	**ALTERNATIVES OJECTIVES**	
1	protect human health and the environment by recycling waste or by, eliminating, reducing, and/or controlling risks to human health and the environment posed through each pathway at the Site	The FS shall be developed in accordance with USEPA guidance as specified in the SOW, including developing RAO, PRGs, initial screening of alternatives, development and detailed analysis of alternatives, comparative analysis of alternatives including cost, and recommendation of a preferred alternative.
2	consider the long-term uncertainties associated with land disposal	The FS shall be developed in accordance with USEPA guidance as specified in the SOW, including developing RAO, PRGs, initial screening of alternatives, development and detailed analysis of alternatives, comparative analysis of alternatives including cost, and recommendation of a preferred alternative.
3	consider the goals, objectives, and requirements of the Solid Waste Disposal Act	The FS shall be developed in accordance with USEPA guidance as specified in the SOW, including developing RAO, PRGs, initial screening of alternatives, development and detailed analysis of alternatives, comparative analysis of alternatives including cost, and recommendation of a preferred alternative.
4	consider the persistence, toxicity, mobility, and propensity to bioaccumulate of hazardous substances and their constituents	The FS shall be developed in accordance with USEPA guidance as specified in the SOW, including developing RAO, PRGs, initial screening of alternatives, development and detailed analysis of alternatives, comparative analysis of alternatives including cost, and recommendation of a preferred alternative.
5	consider the short- and long-term potential for human exposure	The FS shall be developed in accordance with USEPA guidance as specified in the SOW, including developing RAO, PRGs, initial screening of alternatives, development and detailed analysis of alternatives, comparative analysis of alternatives including cost, and recommendation of a preferred alternative.
6	consider the potential threat to human health and the environment if the remedial alternative proposed was to fail	The FS shall be developed in accordance with USEPA guidance as specified in the SOW, including developing RAO, PRGs, initial screening of alternatives, development and detailed analysis of alternatives, comparative analysis of alternatives including cost, and recommendation of a preferred alternative.
7	consider the threat to human health and the environment associated with the excavation, transportation, and re-disposal or containment of contaminated substances and/or media	The FS shall be developed in accordance with USEPA guidance as specified in the SOW, including developing RAO, PRGs, initial screening of alternatives, development and detailed analysis of alternatives, comparative analysis of alternatives including cost, and recommendation of a preferred alternative.

ANOEC - Acute-No Observed-Effects Concentrations
ARAR - Applicable or Relevant and Appropriate Requirements
BERA - Baseline Ecological Risk Assessment
BHHRA - Baseline Human Health Risk Assessment
CSA - Comprehensive Site Assessment
CSL - Calcium Sulfate Landfill
CSM - Conceptual Site Model
ERA - Ecological Risk Assessment
ERC - Environmental Risk Characterization
ES&H - Environmental Safety & Health
FETAX - Frog Embryo Teratogenesis Assay *Xenopus*
FRI - Focused Remedial Investigation
FS - Feasibility Study
MMB - Maple Meadow Brook
MMBW - Maple Meadow Brook Wetland
MNHESP - Massachusetts Natural Heritage and Endangered Species Program
NOI - Notice of Intent
off-PWD - off-Property West Ditch
OHMPC - oil and/or hazardous materials of potential concern
on-PWD - on-Property West Ditch
PM - Project Manager
PPE - Personal protective equipment
RBP - Rapid Bioassessment Protocols
RI - Remedial Investigation
SWMU - Solid Waste Management Unit
US ACE - United States Army Corp of Engineers

Table 3.2-1
Objectives Table

Remedial Investigation/Feasibility Study Work Plan
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OBJECTIVES LISTED IN STATEMENT OF WORK (SOW)	PROPOSED INVESTIGATIONS AND HISTORICAL INFORMATION TO ACHIEVE RI/FS OBJECTIVE

FSP - Field Sampling Plan
IRSWP - Interim Response Steps Work Plan
LEL - Lower explosive limit
USEPA - United States Environmental Protection Agency
USFWS - United States Fish and Wildlife Service

Prepared by / Date: MH 04/29/09
Checked by / Date: PHT 04/30/09

Table 4.2-1
Preliminary Remedial Action Objectives and Preliminary List of Remedial Alternatives and Technologies

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

Medium	Remedial Action Objectives (potential)	General Response Actions	Remedial Technology Types	Possible Data Needs for Evaluation of Technologies
	OU1			
Soil	● Prevent or reduce human exposure to OU1 soils containing concentrations of hazardous materials that are greater than Preliminary Remediation Goals (PRGs) ● Prevent or reduce human exposure to OU1 soils containing concentrations of hazardous materials that are associated with human health cancer risks that are greater than the NCP cancer risk range of 10^{-6} to 10^{-4} and/or greater than a Hazard Index of one (incidental ingestion, dermal contact, and inhalation of dust or vapors).	No action/Institutional Controls	Fencing Deed restriction	Not applicable
		Containment/capping	Capping Vertical barriers Horizontal barriers Surface controls Dust control	Soil physical characteristics, chemical residuals
		Excavation/Treatment	Excavation Disposal In Situ treatment	Soil physical characteristics, chemical residuals
Sediments	●Prevent or reduce human exposure to OU1 sediments containing concentrations of hazardous materials that are greater than PRGs. ● Prevent or reduce human exposure to OU1 sediments containing concentrations of hazardous materials that are associated with human health cancer risks that are greater than the NCP cancer risk range of 10^{-6} to 10^{-4} and/or greater than a Hazard Index of one (incidental ingestion and dermal contact). ● Prevent or reduce aquatic and semi-aquatic receptor exposure to OU1 sediments containing concentrations of hazardous materials that are greater than ecological PRGs	No action/Institutional Controls	Fencing Deed restriction	Not applicable
		Containment	Capping Vertical barriers Horizontal barriers Sediment control barriers	Sediment physical characteristics, chemical residuals
		Excavation/Treatment	Excavation Solidification, fixation, stabilization, dewatering Disposal In Situ treatment Physical treatment Chemical treatment	Sediment physical characteristics, chemical residuals
Surface water	● Prevent or reduce human exposure to OU1 surface water containing concentrations of hazardous materials that are greater than PRGs (incidental ingestion and dermal contact). ● Prevent or reduce human exposure to OU1 surface water containing concentrations of hazardous materials that are associated with human health cancer risks that are greater than the NCP cancer risk range of 10^{-6} to 10^{-4} and/or greater than a Hazard Index of one (incidental ingestion and dermal contact). ● Prevent or reduce aquatic and semi-aquatic receptor exposure to OU1 surface water containing concentrations of hazardous materials that are greater than ecological PRGs	No action/Institutional Controls	Fencing Deed restriction	Not applicable
		Collection/Treatment	Surface controls Physical treatment Chemical treatment Biological treatment In situ treatment	Surface water physical characteristics, chemical residuals, flow rates

Table 4.2-1
Preliminary Remedial Action Objectives and Preliminary List of Remedial Alternatives and Technologies

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

Medium	Remedial Action Objectives (potential)	General Response Actions	Remedial Technology Types	Possible Data Needs for Evaluation of Technologies
	OU2			
Sediments	●Prevent or reduce human exposure to OU1 sediments containing concentrations of hazardous materials that are greater than PRGs. ● Prevent or reduce human exposure to OU2 sediments containing concentrations of hazardous materials that are associated with human health cancer risks that are greater than the NCP cancer risk range of 10^{-6} to 10^{-4} and/or greater than a Hazard Index of one (incidental ingestion and dermal contact). ●Prevent or reduce aquatic and semi-aquatic receptor exposure to OU2 sediments containing concentrations of hazardous materials that are greater than ecological PRGs	No action/Institutional Controls	Fencing Deed restriction	Not applicable
		Containment	Capping Vertical barriers Horizontal barriers Sediment control barriers	Sediment physical characteristics, chemical residuals
		Excavation/Treatment	Excavation Solidification, fixation, stabilization, dewatering Disposal In Situ treatment Physical treatment Chemical treatment	Sediment physical characteristics, chemical residuals
Surface water	●Prevent or reduce human exposure to OU2 surface water containing concentrations of hazardous materials that are associated with human health cancer risks that are greater than the NCP cancer risk range of 10^{-6} to 10^{-4} and/or greater than a Hazard Index of one (incidental ingestion and dermal contact). ● Prevent or reduce aquatic and semi-aquatic receptor exposure to OU2 surface water containing concentrations of hazardous materials that are greater than ecological PRGs	No action/Institutional Controls	Fencing Deed restriction	Not applicable
		Collection/Treatment	Surface controls Physical treatment Chemical treatment Biological treatment In situ treatment	Surface water physical characteristics, chemical residuals, flow rates
	OU3			
Groundwater	●Prevent human ingestion, dermal contact, and inhalation exposures related to groundwater used as drinking water containing hazardous materials with concentrations greater than MCLs and associated with human health cancer risks that are greater than the NCP cancer risk range of 10^{-6} to 10^{-4} and/or greater than a Hazard Index of one ● Prevent or prevent vapor intrusion (from ground water to indoor air) that might result in indoor air concentrations greater than human health inhalation PRGs. Alternatively phrase this in the context of vapor intrusion-based groundwater PRGs. ● Prevent human ingestion, dermal contact, and inhalation exposures related to groundwater used for irrigation purposes containing hazardous materials with concentrations greater than groundwater PRGs and associated with human health cancer risks that are greater than the NCP cancer risk range of 10^{-6} to 10^{-4} and/or greater than a Hazard Index of one	No action/Institutional Controls Natural Attenuation	Deed restriction Natural Attenuation	Not applicable
	● Prevent human ingestion, dermal contact, and inhalation exposures related to groundwater used for industrial/commercial process water containing hazardous materials with concentrations greater than groundwater PRGs and associated with human health cancer risks that are greater than the NCP cancer risk range of 10^{-6} to 10^{-4} and/or greater than a Hazard Index of one	Containment	Capping Vertical barriers Horizontal barriers	Horizontal and vertical extent, physical characteristics, chemical residuals
	● Prevent migration of hazardous materials from groundwater/liquid wastes to surface water with concentrations associated with human health cancer risks that are greater than the NCP cancer risk range of 10^{-6} to 10^{-4} and/or greater than a Hazard Index of one (incidental ingestion and dermal contact). ● Prevent migration of hazardous materials from groundwater/liquid wastes to surface water with concentrations greater than aquatic and semi-aquatic receptor PRGs ● Prevent migration of hazardous materials from groundwater/liquid wastes to sediment with concentrations associated with human health cancer risks that are greater than the NCP cancer risk range of 10^{-6} to 10^{-4} and/or greater than a Hazard Index of one (incidental ingestion and dermal contact). ●Prevent migration of hazardous materials from groundwater/liquid wastes to sediment with concentrations greater than aquatic and semi-aquatic receptor PRGs	Collection/Treatment	Groundwater pumping Physical treatment Chemical treatment In situ treatment	Horizontal and vertical extent, groundwater and subsurface soil physical characteristics, chemical residuals

Physical parameters may include: soil density, soil moisture, soil types, soil gradation, BTU values, total halogens, total organic carbon, waste and soil properties such as moisture content, unit weight, strength parameters, and chemical and physical data may need to be obtained during the RI through field and laboratory testing to evaluate slope stability and rate of settlement.

Table 4.2-1
Preliminary Remedial Action Objectives and Preliminary List of Remedial Alternatives and Technologies

Volume I Project Overview
Olin Chemical Superfund Site
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Medium	Remedial Action Objectives (potential)	General Response Actions	Remedial Technology Types	Possible Data Needs for Evaluation of Technologies
				Prepared By: MJM
				Checked By: MH

Table 7.0-1
Preliminary Action-Specific ARARs, Criteria, Advisories, and Guidance

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

Regulatory Authority	Action/Trigger	Requirement	Status	Requirement Synopsis	Action To Be Taken To Attain Requirement
Federal	Management of IDW from sampling of monitoring wells	USEPA OSWER Publication 9345.3-03FS, January 1992	To Be Considered	Management of IDW must ensure protection of human health and the environment.	IDW produced from well sampling will comply with ARAR.
Federal	Identification of hazardous wastes	RCRA Identification and Listing of Hazardous Waste; Toxicity Characteristic [40 CFR 261.24]	Applicable	This requirement defines those wastes that are subject to regulation as hazardous waste under 40 CFR Parts 124 and 264.	Analytical results will be evaluated against the criteria and definitions of hazardous waste. The criteria and definition of hazardous waste will be referred to and utilized in development of alternatives and during remedial actions.
Federal	Storage and disposal of hazardous wastes	RCRA Standards Applicable to Generators of Hazardous Waste [40 CFR Part 262]	Applicable	These standards govern storage, labeling, accumulation times, and disposal of hazardous waste.	Any hazardous waste generated during the RI/FS activities will be managed in accordance with these standards.
Federal	Tracking of hazardous wastes	RCRA Manifest System, Recordkeeping, and Reporting [40 CFR Part 264, Subpart E]	Applicable	This regulation outlines the requirements to track hazardous waste activities, including the manifest system, operating records, and reporting.	Remedial action activities will be conducted to comply with the facility's requirements in accordance with this regulation.
Federal	Use of containers to store hazardous wastes	RCRA Container Storage Requirements [40 CFR Part 264, Subpart I]	Applicable	These requirements apply to owners and operators of facilities that use container storage to store hazardous waste.	If containers are used to store materials that are hazardous wastes, the containers will be managed according to these rules.
Federal	Groundwater monitoring of hazardous waste landfill	RCRA Groundwater Monitoring [40 CFR Parts 264 and 265, Subpart F]	Applicable	The regulations in Subpart F of Parts 264/265 are general requirements, establishing performance-based standards that state what a successful groundwater monitoring program must accomplish; they do not dictate specific technical standards. These regulations are on part of an overall strategy to reduce the likelihood of environmental contamination resulting from hazardous waste treatment, storage, and disposal.	Remedial action activities will be conducted to comply with the facility's requirements in accordance with this regulation.
Federal	Closure/post-closure of hazardous waste landfill	RCRA Closure/Post-Closure [40 CFR Parts 264 and 265, Subpart G]	Applicable	The regulations in Subpart G of Parts 264/265, establish how to close the hazardous waste facility in a way that ensures it will not pose a future threat to human health and the environment.	Remedial action activities will be conducted to comply with the facility's requirements in accordance with this regulation.

Table 7.0-1
Preliminary Action-Specific ARARs, Criteria, Advisories, and Guidance

Volume I Project Overview
Olin Chemical Superfund Site
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Regulatory Authority	Action/Trigger	Requirement	Status	Requirement Synopsis	Action To Be Taken To Attain Requirement
Federal	Disposal of soil that contains hazardous waste	RCRA LDRs [40 CFR 268]	Applicable	Land disposal of RCRA hazardous wastes without specified treatment is restricted. LDRs require that such wastes must be treated either by a treatment technology or to a specific concentration prior to disposal in a RCRA Subtitle C permitted facility.	Waste materials will be evaluated to determine whether the waste is subject to LDRs. If so, the materials will be treated in accordance with LDRs prior to disposal at an off-site facility.
Federal	Discharge to a POTW	General Pretreatment Regulations for Existing and New Sources of Pollution [40 CFR 403]	Applicable	Establishes responsibilities of Federal, State, and local government, industry and the public to implement National Pretreatment Standards to control pollutants which pass through or interfere with treatment processes in POTWs or which may contaminate sewage sludge.	If remedial actions result in liquid waste streams that are discharged to a POTW, pretreatment of such waste streams will be evalauted for compliance with applicable requirements of the regulation.
Federal	Emissions of hazardous air pollutants	National Emissions Standards for Hazardous Air Pollutants [40 CFR 61]	Applicable	These regulations apply to any stationary source of substances designated as hazardous air pollutants or have serious health effects from ambient exposure to the substance.	Remedial actions which require excavation of soil material, onsite treament, or in-situ treatment of other contaminants that have potential to generate fugitive emissions will be evalauted for compliance with these standards.
Federal	Underground Injections	Underground Injection Control Regulations [40 CFR 144]	Applicable	These regulations state that no injection shall be authorized by permit or rule if it results in the movement of fluid containing any contaminant into Underground Sources of Drinking Water (USDWs—see §144.3 for definition), if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 CFR part 141 or may adversely affect the health of persons (§144.12).	The remedial actions currently envisioned for the FS are not likely to consider underground injection as a component of a treatment train. If underground injection is considered as a potential treatment option, the federal regulations will be considered.
Federal	Treating, storing, or disposing of hazardous wastes (generators)	RCRA Standards Applicable to Generators of Hazardous Waste [40 CFR Part 262]	Relevant and Appropriate	These regulations establish standards for generators of hazardous waste. RCRA Subtitle C established standards applicable to treatment, storage, and disposal of hazardous waste and closure of hazardous waste facilities.	Site media would be evaluated to determine whether they contain characteristic hazardous waste. If so, management of the media would comply with substantive requirements of these regulations.
Federal	Transporting manifested hazardous wastes	RCRA Standards Applicable to Transporters of Hazardous Waste [40 CFR Part 263]	Relevant and Appropriate	This regulation establishes procedures to be followed when transporting manifested hazardous waste within the United States.	Transporters of hazardous waste for off-Site treatment and/or disposal will comply with these requirements.

Table 7.0-1
Preliminary Action-Specific ARARs, Criteria, Advisories, and Guidance

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

Regulatory Authority	Action/Trigger	Requirement	Status	Requirement Synopsis	Action To Be Taken To Attain Requirement
Federal	Discharge to surface water body	Clean Water Act AWQC	Relevant and Appropriate	National recommended AWQC were developed by the USEPA under Section 304(a)(1) of the Clean Water Act. These criteria are based solely on data and scientific judgments on pollutant concentrations and environmental or human health effects to be protective of aquatic life and human health.	Remedial action activities will be conducted to comply with AWQCs.
State	Identification of hazardous waste	Massachusetts Hazardous Waste Management Rules [310 CMR 30.000]	Applicable	These regulations outline requirements and procedures for handling, storage, treatment, disposal, and record keeping at hazardous waste facilities.	These regulations supplement RCRA requirements and will be evaluated to determine compliance with the substantive requirements of Massachusetts hazardous waste regulations.
State	Solid waste landfill construction, operation, closure, and post-closure	Massachusetts Solid Waste Management Regulations [310 CMR 19.100]	Applicable	These regulations outline the requirements for construction, operation, closure, and post-closure at solid waste management facilities in the Commonwealth of Massachusetts.	The requirements are taken into consideration in the closure certification of the Calcium Sulfate Landfill.
State	Activities that potentially affect surface water quality	Massachusetts Water Quality Certification and Certification for Dredging [314 CMR 9.00]	Applicable	A Massachusetts Division of Water Pollution Control Water Quality Certification is required pursuant to 314 CMR 9.00 for dredging-related activities in waters (including wetlands) within the Commonwealth which require federal licenses or permits and which are subject to state water quality certification.	Excavation and filling activities considered in the RI/FS process will be evaluated to meet the substantive criteria and standards of these regulations.

Table 7.0-1
Preliminary Action-Specific ARARs, Criteria, Advisories, and Guidance

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

Regulatory Authority	Action/Trigger	Requirement	Status	Requirement Synopsis	Action To Be Taken To Attain Requirement
State	Activities that potentially affect surface water quality	Massachusetts Surface Water Discharge Permit Program [314 CMR 3.00]	Applicable	Implements the provisions of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26 through 53, and the Federal Clean Water Act, 33 U.S.C. 1251 et seq., as applied to surface water discharges, and to ensure that 314 CMR 3.00 confer sufficient authority on the Department to assume delegation from the USEPA to administer the NPDES permit program within the Commonwealth. 314 CMR 3.06 also confers authority on the Department to issue general permits for surface water discharges, including general permits for storm water discharges from small municipal separate sewer systems regulated under USEPA's Phase II Storm Water Regulations set forth in the applicable provisions of 40 CFR Part 122, Subpart B.	The MA Surface Water Discharge Permit requirements will be considered in development and evalaution of alternatives during the RI/FS that contemplate surface water discharges, if any.
State	Activities that potentially affect groundwater quality	Massachusetts Groundwater Discharge Permit Program [314 CMR 5.00]	Applicable	These regulations control the discharge of pollutants to groundwater to assure that groundwaters are protected for their actual and potential use as a source of potable water and surface waters are protected for their existing and designated uses and to assure attainment and maintenance of Massachusetts Surface Water Quality Standards. These regulations relate to discharge of groundwater, outlets for such discharges and treatment related to discharges.	The MA Groundwater Discharge Permit requirements will be considered in development and evalaution of alternatives during the RI/FS that contemplate surface water discharges, if any.
State	Emissions of hazardous air pollutants	Massachusetts Air Pollution Control [310 CMR 7.00] and Remedial Air Emissions [310 CMR 40.0049]	Applicable	Regulations governing emissions of hazardous air pollutants.	Remedial actions which have potential to cause emission of hazardous air pollutants will consider these regulations, if applicable

Table 7.0-1
Preliminary Action-Specific ARARs, Criteria, Advisories, and Guidance

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

Regulatory Authority	Action/Trigger	Requirement	Status	Requirement Synopsis	Action To Be Taken To Attain Requirement
State	Underground Injections	Massachusetts Underground Injection Control Regulations [310 CMR 27]	Applicable	Regulations protection underground sources of drinking water by regulating the underground injection of hazardous wastes, fluids used for extraction of minerals, oil, and energy and any other fluids having potential to contaminate groundwater as required by the Federal Safe Drinking Water Act.	The remedial actions currently envisioned for the FS are not likely to consider underground injection as a component of a treatment train. However, if an alternative developed in the FS contemplates re-injection of treated water, both these and the federal regulations will be considered.

Prepared By / Date: MH 06/30/08
Checked By / Date: MJM 06/30/08

Notes:
ARAR = Applicable or Relevant and Appropriate Requirement
AWQC = Ambient Water Quality Criteria
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
IDW = Investigation Derived Waste
LDRs = Land Disposal Restrictions
NPDES = National Pollution Discharge Elimination System
OSWER = Office of Solid Waste and Emergency Response
POTW = Publicly Owned Treatment Works
RCRA = Resource Conservation and Recovery Act
RI/FS = Remedial Investigation/Feasibility Study
USEPA = United States Environmental Protection Agency

Table 7.0-2
Preliminary Chemical-Specific ARARs, Criteria, Advisories, and Guidance

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

Regulatory Authority	Requirement	Status	Requirement Synopsis	Action To Be Taken To Attain Requirement
Federal	Safe Drinking Water Act, National Primary Drinking Water Regulations, MCLs, and MCLGs [40 CFR Parts 141.60 - 141.63 and 141.50 - 141.52]	Relevant and Appropriate	The National Primary Drinking Water Regulations establish MCLs and MCLGs for several common organic and inorganic contaminants. MCLs specify the maximum permissible concentrations of contaminants in public drinking water supplies. MCLs are federally enforceable standards based in part on the availability and cost of treatment techniques. MCLGs specify the maximum concentration at which no known or anticipated adverse effect on humans will occur. MCLGs are non-enforceable health based goals set equal to or lower than MCLs.	MCLs and nonzero MCLGs will be considered during the development of the RI/FS and cleanup goals. Cleanup actions will be designed and implemented to attain the concentration limits of these regulations.
Federal	Drinking Water Health Advisory for Manganese, January 2004 [EPA-822-R-04-003]	To Be Considered	This advisory provides guidelines for addressing manganese contamination problems and an analysis of the current health hazard information. Recommended RfDs and modifying factors for evaluation of exposure are presented.	Advisory will be considered during the development of the RI/FS and cleanup goals.
Federal	Clean Water Act AWQC	Relevant and Appropriate	National recommended AWQC were developed by the USEPA under Section 304(a)(1) of the Clean Water Act. These criteria are based solely on data and scientific judgments on pollutant concentrations and environmental or human health effects to be protective of aquatic life and human health.	AWQCs will be considered during the development of the RI/FS and cleanup goals.
Federal	USEPA Risk RfDs	To Be Considered	Risk RfDs are estimates of daily exposure levels that are unlikely to cause significant adverse non-carcinogenic health effects over a lifetime.	RfDs will be considered during the development of the RI/FS and cleanup goals.
Federal	USEPA Carcinogen Assessment Group, CSFs	To Be Considered	CSFs are used to compute the incremental cancer risk from exposure to site contaminants and represent the most up-to-date information on cancer risk from USEPA's Carcinogen Assessment Group.	CSFs will be considered during the development of the RI/FS and cleanup goals.

Table 7.0-2
Preliminary Chemical-Specific ARARs, Criteria, Advisories, and Guidance

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

Regulatory Authority	Requirement	Status	Requirement Synopsis	Action To Be Taken To Attain Requirement
Federal	Regional Screening Levels for Chemical Contaminants at Superfund Sites	To Be Considered	USEPA Screening Levels are risk-based tools for screening contaminants at Superfund sites. The Screening Levels represent USEPA guidelines and are not legally enforceable standards.	USEPA Screening Levels will be considered during the development of the RI/FS for soil and groundwater exposure scenario and for development of COPCs for the baseline human health risk assessment.
Federal	Guidelines for Carcinogen Risk Assessment	To Be Considered	The Guidelines provide a framework for assessing possible cancer risks from exposures to pollutants or other agents in the environment.	These guidelines will be considered in the development of the BHHRA and the RI/FS cleanup goals.
Federal	Supplemental Guidance for Assessing Susceptibility from Early Life Exposure to Carcinogens	To Be Considered	The Supplemental Guidance addresses a number of issues pertaining to cancer risks associated with early-life exposures generally, but provides specific guidance on potency adjustment only for carcinogens acting through a mutagenic mode of action.	This supplemental guidance will be considered in the development of the BHHRA and the RI/FS cleanup goals.
State	Massachusetts Groundwater Quality Standards [314 CMR 6.00]	Relevant and Appropriate	These standards designate and assign uses for which groundwaters of the Commonwealth shall be maintained and protected, and set forth water quality criteria necessary to maintain the designated uses.	Cleanup goals will be evaluated during development of the RI/FS and cleanup goals for groundwater.
State	Massachusetts Surface Water Quality Standards [314 CMR 4.00]	Relevant and Appropriate	To achieve the requirements of protecting the public health and enhancing the quality and value of the water resources of the Commonwealth, the Department has adopted the MA Surface Water Quality Standards which designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained and protected; which prescribe the minimum water quality criteria required to sustain the designated uses; and which contain regulations necessary to achieve the designated uses and maintain existing water quality including, where appropriate, the prohibition of discharges.	The MA Surface Water Quality Standards will be considered during the development of RI/FS cleanup goals for surface water and in evalaution of treatment options for surface water discharge if considered.

Table 7.0-2
Preliminary Chemical-Specific ARARs, Criteria, Advisories, and Guidance

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

Regulatory Authority	Requirement	Status	Requirement Synopsis	Action To Be Taken To Attain Requirement
State	MCP Identification of Site Groundwater Categories [310 CMR 40.0930 - 40.0932]	To Be Considered	MCP groundwater categories are used to describe the types of exposure that may occur to groundwater and, consequently, the applicability of Massachusetts Drinking Water Standards and Guidelines.	Identification of groundwater categories for the Site will be considered during the development of the RI/FS and cleanup goals.
State	Massachusetts Drinking Water Regulations [310 CMR 22.00]	Applicable	The Massachusetts Drinking Water Standards list MMCLs which apply to water delivered to any user of a public water supply system as defined in 310 CMR 22.00.	MMCLs will be considered during development of the RI/FS and cleanup goals.
State	Massachusetts Drinking Water Guidelines	To Be Considered	The Massachusetts Drinking Water Guidelines are developed by ORS as guidance for chemicals other than those with MMCLs in drinking water.	The MA Drinking Water Guidelines will be considered during development of RI/FS and cleanup goals for those chemicals that do not have a State MMCL or a Federal MCL.

Prepared By / Date: MH 06/30/08
Checked By / Date: MJM 06/30/08

Notes:
ARAR = Applicable or Relevant and Appropriate Requirement
AWQC = Ambient Water Quality Criteria
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
COPC = Chemical of Potential Concern
CSF = cancer slope factor
MCLs = Maximum Contaminant Levels
MCLGs = Maximum Contaminant Level Goals
MCP = Massachusetts Contingency Plan
MMCLs = Massachusetts Maximum Contaminant Levels
RfD = reference dose
RI/FS = Remedial Investigation/Feasibility Study
USEPA = United States Environmental Protection Agency

Table 7.0-3
Preliminary Location-Specific ARARs, Criteria, Advisories, and Guidance

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

Regulatory Authority	Location Characteristic	Requirement	Status	Requirement Synopsis	Action To Be Taken To Attain Requirement
Federal	Floodplains	Floodplain Management Executive Order 11988 [40 CFR Part 6, Appendix A]	Applicable	Requires federal agencies to evaluate the potential adverse effects associated with direct and indirect development of a floodplain. Alterna-tives that involve modification/construction within a floodplain may not be selected unless a determination is made that no practicable alternative exists. If no practicable alternative exists, potential harm must be minimized and action taken to restore and preserve the natural and beneficial values of the floodplain.	Evaluation of contaminated soil remedies will be evaluated to minimize alteration/destruction of floodplain areas. Floodplains affected by remedial activities be restored to original elevations.
Federal	Wetlands, Aquatic Ecosystem	CWA, Dredge or Fill Requirements Section 404 [40 CFR Part 230]	Relevant and Appropriate	Section 404 of the CWA regulates the discharge of dredged or fill materials to U.S. waters, including wetlands. Filling wetlands would be considered a discharge of fill materials. Guidelines for Specification of Disposal Sites for Dredged or Fill material at 40 CFR Part 230, promulgated under CWA Section 404(b)(1), maintain that no discharge of dredged or fill material will be permitted if there is a practical alternative that would have less effect on the aquatic ecosystem. If adverse impacts are unavoidable, action must be taken to restore, or create alternative wetlands.	The remediation/removal of soil/sediment from wetland or surface water areas may be evaluated in the RI/FS process. A Massachusetts PGP (granted by the USACE) is typically required prior to excavating/restoring any sediment. Remedial actions would need to adhere to substantive requirements of the PGP.
Federal	Surface Waters, Endangered Species, Migratory Species	Fish and Wildlife Coordination Act [16 USC 661 et seq.]	Relevant and Appropriate	Actions that affect species/habitat require consultation with USDOI, USFWS, NMFS, and/or state agencies, as appropriate, to ensure that proposed actions do not jeopardize the continued existence of the species or adversely modify or destroy critical habitat. The effects of water-related projects on fish and wildlife resources must be considered. Action must be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources. Consultation with the responsible agency is also strongly recommended for on-site actions. Under 40 CFR Part 300.38, these requirements apply to all response activities under the NCP.	To the extent necessary, actions will be evaluated or taken to develop measures to prevent, mitigate, or compensate for project related impacts to habitat and wildlife. The USFWS, acting as a review agency for the USEPA, will be kept informed of proposed remedial activities.

Table 7.0-3
Preliminary Location-Specific ARARs, Criteria, Advisories, and Guidance

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

Regulatory Authority	Location Characteristic	Requirement	Status	Requirement Synopsis	Action To Be Taken To Attain Requirement
Federal	Surface Waters	Clean Water Act AWQC	Applicable	National recommended AWQC were developed by the USEPA under Section 304(a)(1) of the Clean Water Act. These criteria are based solely on data and scientific judgments on pollutant concentrations and environmental or human health effects to be protective of aquatic life and human health.	AWQCs will be considered during the development of the RI/FS and cleanup goals.
Federal	Endangered Species	Endangered Species Act [50 CFR Parts 17.11-17.12]	Relevant and Appropriate	This act requires action to avoid jeopardizing the continued existence of listed endangered or threatened species or modification of their habitat.	Protection of endangered species and their habitat will be considered as part of the RI/FS process.
Federal	Atlantic Flyway, Wetlands, Surface Waters	Migratory Bird Treaty Act [16 USC 703 et seq.]	Relevant and Appropriate	The Migratory Bird Treaty Act protects migratory birds, their nests, and eggs. A depredation permit is required to take, possess, or transport migratory birds or disturb their nests, eggs, or young.	Remedial activities will be evaluated to protect migratory birds, their nests, and eggs.
Federal	Calcium Sulfate Landfill	RCRA Subtitle C	Relevant and Appropriate	RCRA Subtitle C addresses hazardous waste management with a cradle-to-grave management system.	RCRA Subtitle C will be considered during the development of the RI/FS and cleanup goals.
Federal	Calcium Sulfate Landfill	RCRA Subtitle D	Relevant and Appropriate	RCRA Subtitle D addresses nonhazardous waste and hazardous wastes that are excluded from Subtitle C regulation. Subtitle D includes criteria for solid waste disposal facilities.	RCRA Subtitle D will be considered during the development of the RI/FS and cleanup goals.
Federal	Indoor air	OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance), EPA530-D-02-004	To Be Considered	This draft guidance specifically addresses the evaluation of the "vapor intrusion pathway" with the intention of providing a tool to help the user conduct a screening evaluation as to whether or not the vapor intrusion exposure pathway is complete and, if so, whether it poses an unacceptable risk to human health.	This guidance document will be considered during the development of the RI/FS and cleanup goals.
Federal	Indoor air	Supplemental Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway (Vapor Intrusion Guidance)	To Be Considered	This document provides guidance for assessing if the subsurface vapor intrusion to indoor air pathway for human exposure is complete under current site conditions.	This guidance document will be considered during the development of the RI/FS and cleanup goals.

Table 7.0-3
Preliminary Location-Specific ARARs, Criteria, Advisories, and Guidance

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

Regulatory Authority	Location Characteristic	Requirement	Status	Requirement Synopsis	Action To Be Taken To Attain Requirement
State	Floodplains, Wetlands, Surface Waters	Massachusetts Wetland Protection Regulations [310 CMR 10.00]	Applicable	These regulations include standards on dredging, filling, altering, or polluting inland wetlands and protected areas (defined as areas within the 100-year floodplain). A NOI must be filed with the municipal conservation commission and a Final Order of Conditions obtained before proceeding with the activity. A Determination of Applicability or NOI must be filed for activities such as excavation within a 100 foot buffer zone. The regulations specifically prohibit loss of over 5,000 square feet of bordering vegetated wetland. Loss may be permitted with replication of any lost area within two growing seasons.	All work to be performed within wetlands and the 100 foot buffer zone will be in accordance with the substantive requirements of these regulations.
State	Endangered Species	Massachusetts Endangered Species Regulations [321 CMR 8.00]	Applicable	Actions must be conducted in a manner that minimizes the impact to Massachusetts-listed rare, threatened, or endangered species, and species listed by the Massachusetts Natural Heritage Program.	The protection of state listed endangered species will be considered during the design and implementation of remedial activities.
State	Area of Critical Environmental Concern	ACEC [301 CMR 12.00]	Relevant and Appropriate	An ACEC is of regional, state, or national importance or contains significant ecological systems with critical interrelationships among a number of components. An eligible area must contain features from four or more of the following groups: (1) fishery habitats; (2) coastal feature; (3) estuarine wetland; (4) inland wetland; (5) inland surface water; (6) water supply area (i.e., aquifer recharge area); (7) natural hazard area (i.e., floodplain); (8) agricultural area; (9) historical/archeological resources; (10) habitat resource (i.e., for endangered wildlife; or (11) special use areas.	Should ACEC be identified, activities must be controlled to minimize impacts to affected species.

Prepared By / Date: MH 06/30/08
Checked By / Date: MJM 06/30/08

Notes:
ACEC = Areas of Critical Environmental Concern
ARAR = Applicable or Relevant and Appropriate Requirement
AWQC = Ambient Water Quality Criteria

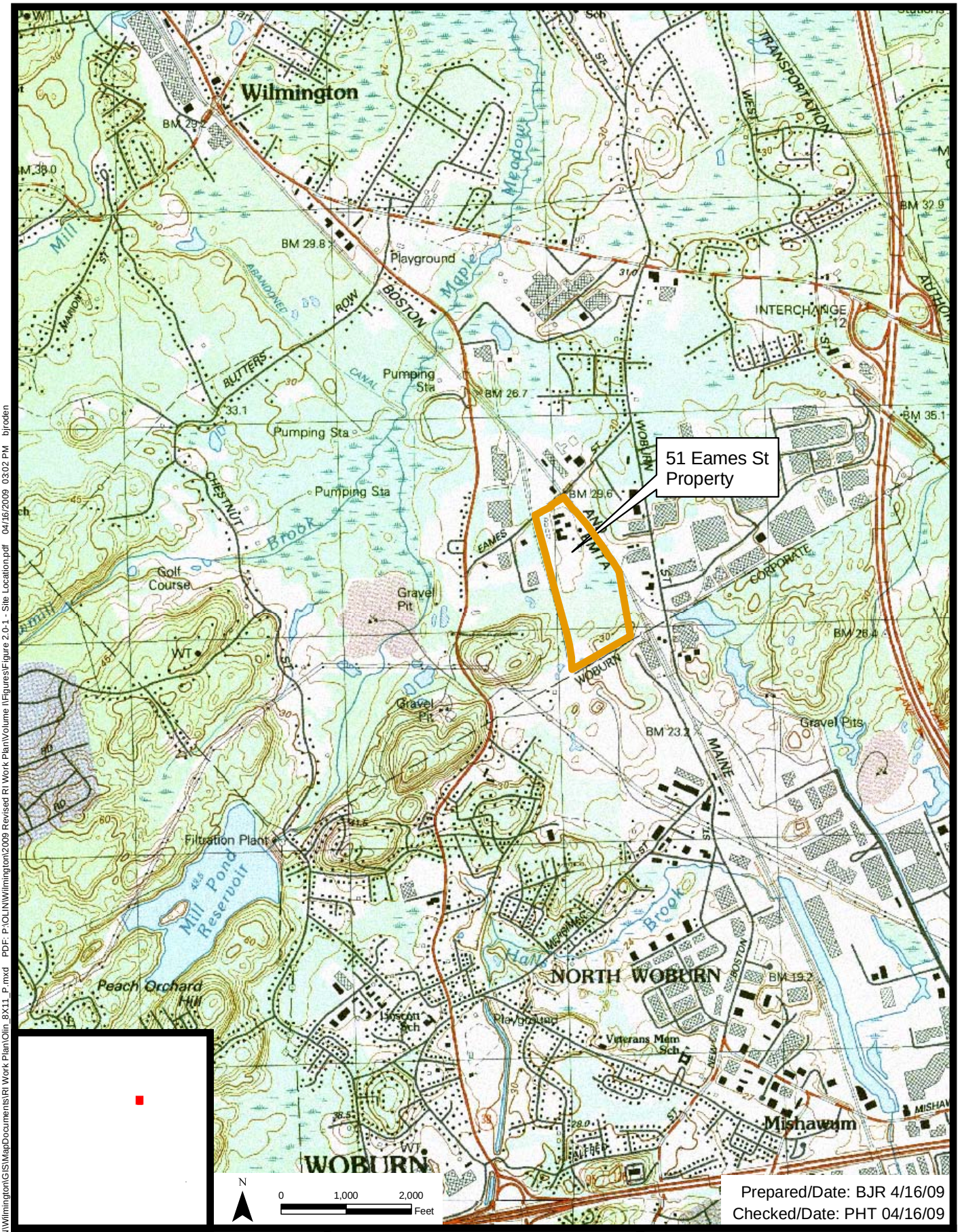
Table 7.0-3
Preliminary Location-Specific ARARs, Criteria, Advisories, and Guidance

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

Regulatory Authority	Location Characteristic	Requirement	Status	Requirement Synopsis	Action To Be Taken To Attain Requirement

CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
CWA = Clean Water Act
NCP = National Contingency Plan
NMFS = National Marine Fisheries Service
NOI = Notice of Intent
PGP = Programmatic General Permit
USACE = United States Army Corps of Engineers
USDOI = United States Department of the Interior
USEPA = United States Environmental Protection Agency
USFWS = United States Fish and Wildlife Service
USC = United States Code

FIGURES



Prepared/Date: BJR 4/16/09
Checked/Date: PHT 04/16/09

Olin Chemical Superfund Site
Wilmington, Massachusetts

MACTEC

Figure 2.0-1
Site Location
Volume I Project Overview

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Butters Row
Butters Row Treatment Plant
Butters Row #2
Town Park
Butters Row #1
Chestnut St
Chestnut St #1A/2
Chestnut St #1
Sawmill Brook
Maple Meadow Brook
Spinazola Landfill
Main St
Eames St
Boston and Maine Railroad
MBTA Rail Line
East Ditch
Off-Property West Ditch
Containment Area
Cook Ave
South Ditch
Border Ave
Calcium Sulfate Landfill
Town of Wilmington
City of Woburn
Woburn Landfill
New Boston Street Drainway

Legend

- 51 Eames St. Property Boundary
- Town Wells
- Town Line
- Paved Road
- Unpaved Road
- Sidewalks
- Structures
- Surface Water
- Trails
- Wooded Areas
- Wetland Boundary
- Culvert

MACTEC Engineering and Consulting
107 Audubon Road Suite 301
Wakefield, MA 01880

N

0 340 680 1,360 Feet

Figure 2.0-2
Site Features

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared/Date: BJR 04/28/09 | Checked/Date: MJM 04/28/09

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Former Fisons Office Building
Guard Shack
Former Lab
Butler Building
Former Plant B Tank Farm
Pilot Lab
Plant B Production Area
Boston and Maine Railroad
Finished Product Storage
Plant A
Plant B Treatment Bldg.
Maintenance Shop
Plant C-1
Plant C-2
Boiler House
Plant C-3
Stockroom
MBTA Rail Line
Plant D Tank Farm
Plant D
East Pit
West Pit
Drum Storage Area
Lake Poly
West Ditch Wetland
East Warehouse
East Ditch
West Warehouse
Former Wastewater Treatment Plant
Buried Debris Area
Acid Pits
Drum Area A
Lined Lagoon I
Drum Area B
On-Property West Ditch
Lined Lagoon II
Off-Property West Ditch
Central Pond
South Ditch
Off-Property South Ditch
Ephemeral Drainage
Calcium Sulfate Landfill
Town of Wilmington
City of Woburn

Legend

- Town Line
- Drain/Sewer Line
- Trail
- Paved Road
- Unpaved Road
- Railroad
- Structure
- Surface Water
- Wetland Boundary
- 51 Eames St Property Boundary
- Containment Structure (current feature, not historical)

MACTEC Engineering and Consulting
107 Audubon Road Suite 301
Wakefield, MA 01880

N

0 100 200 400 Feet

Figure 2.0-3
Historical Facility Features

Volume I Project Overview
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared/Date: BJR 04/16/09 | Checked/Date: MJM 04/16/09

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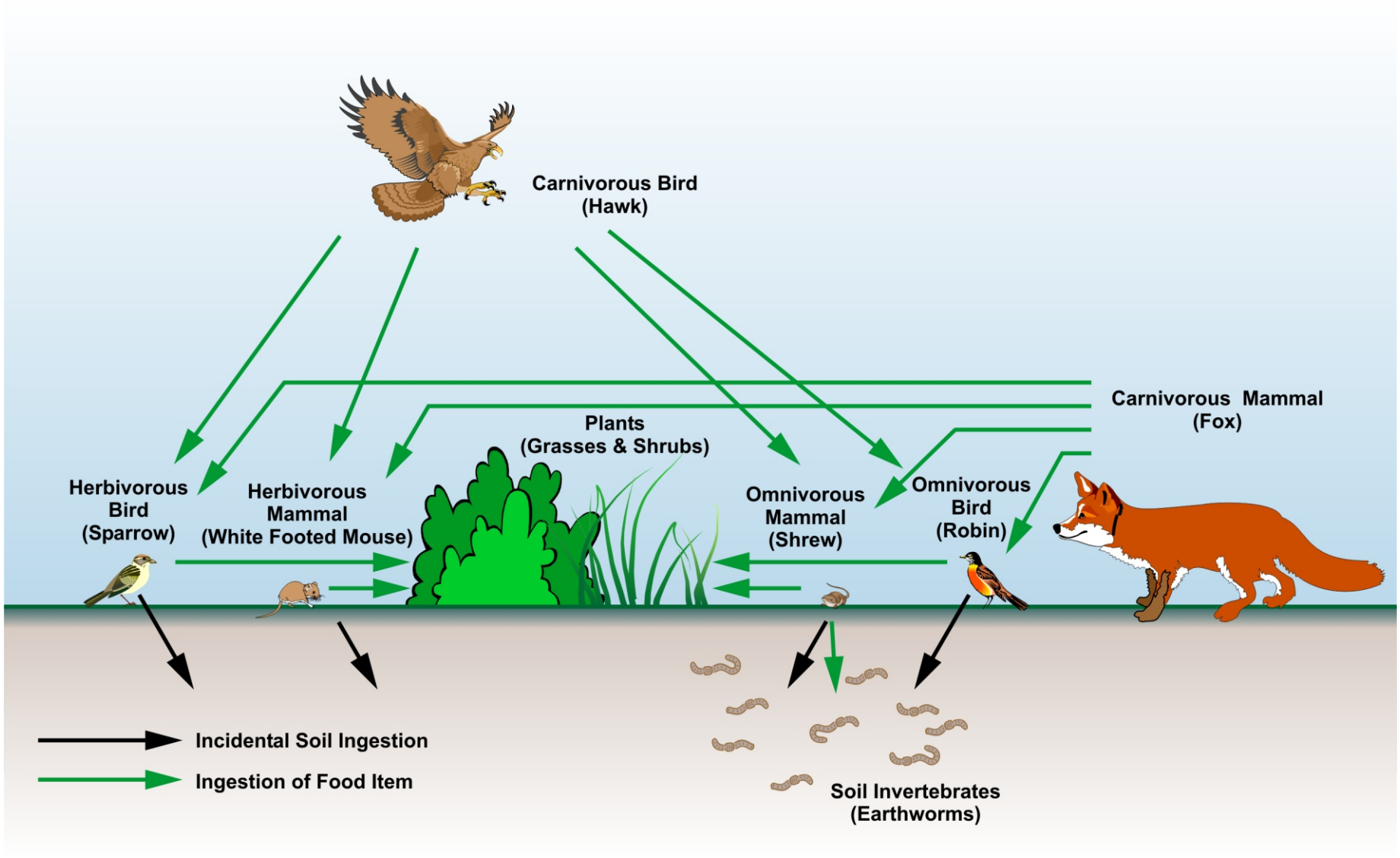
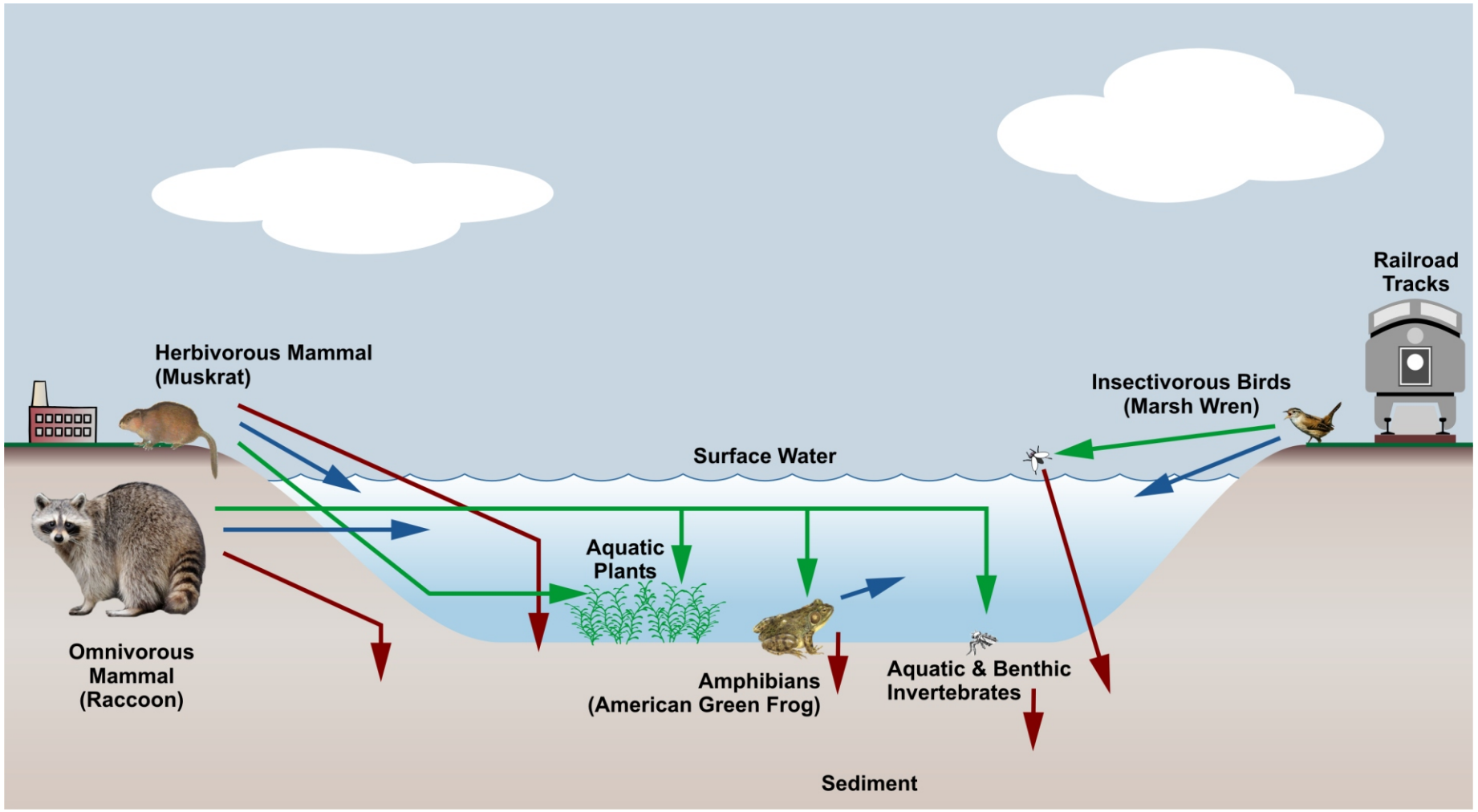


Prepared/Date: JPH 4/14/09
Checked/Date: AMR 4/14/09

Olin Chemical Superfund Site Wilmington, Massachusetts	MACTEC	Figure 6.3-1 Ecological Conceptual Site Model OU-1 Terrestrial Area Volume I Project Overview



Prepared/Date: JPH 4/17/09
Checked/Date: SEB 4/17/09

Olin Chemical Superfund Site Wilmington, Massachusetts	MACTEC	Figure 6.3-2 Ecological Conceptual Site Model OU1/OU2 Aquatic Areas Volume I Project Overview

PORT2009015b.cdr

Expanded Schedule for Remedial Investigation/Feasibility Study

Months Since Approval of RI/FS Work Plan

Activity Name	Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Expanded Schedule for Remedial Investigation/Feasibility Study																																																				
RI/FS Implementation Schedule																																																				
RI/FS Work Plan																																																			
USEPA Approval of RI/FS Work Plan	◆																																																		
RI/FS Field Work																																																			
Mobilization		■																																																		
Access Agreements	■	■	■																																																	
OU1 Field Investigation Activities		■	■	■	■	■	■																																												
OU2 Field Investigation Activities Round 1				■	■	■																																													
OU3 Field Investigation Activities Round 1		■	■	■	■	■	■																																												
Receive Analytical Data OU1, OU2 (R1), OU3 (R1)								■	■																																											
Validate Analytical Data OU1, OU2 (R1), OU3 (R1)									■	■																																										
OU2 Field Investigation Activities Round 2										■	■	■																																							
OU3 Field Investigation Activities Round 2										■	■	■																																							
Receive Analytical Data OU1, OU2 (R2), OU3 (R2)														■	■																																						
Validate Analytical Data OU1, OU2 (R2), OU3 (R2)															■	■																																					
DAPL Pilot Extraction Pilot Test																																																				
Access Agreement	■	■																																																		
Town Planning Board Approvals	■	■																																																		
DAPL Pilot Construction			■	■	■	■																																													
Conduct Pilot Test					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																																	
Prepare and Submit Pilot Test Report																		■	■	■	■																															
Respond to USEPA Pilot Test Comments																					■	■	■	■																													
RI/FS Reports																																																			
Baseline Human Health and Ecological Risk Assessment & RI Report																																																		
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Submit Final HH/Eco RA Reports																																■	■																
USEPA Approval of Baseline RA Reports																																	■																
RI Report																																																		
Initiate RI Report (Sections 1-5)										■	■	■	■	■																																				
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Submit Draft RI Report																																			■	■												
USEPA Review and Comment																																				■												
Olin Respond to Comments																																				■	■										
Prepare and Submit Final RI Report																																					■	■									
USEPA Approval of RI Report																																						■									
Feasibility Study																																																		
Prepare and Submit Initial Screening of Alternatives Report																																																	
Prepare and Submit Draft OU1,OU2, OU3 FS Report																																																
USEPA Review and Comment on Draft FS Report																																																
Olin Review and Response to USEPA Comments																																																
USEPA and Olin Concurrence on Draft FS Comments																																																
Prepare and Submit Final FS Report																																																

■ Activity

◆ ◆ Milestone

MACTEC

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Prepared by: Rena Armstrong Date: 04/29/09

Checked by: Peter Thompson Date: 04/29/09

Figure 8.0-1
Expanded Schedule for Remedial Investigation/Feasibility Study
Olin Chemical Superfund Site
Wilmington, Massachussetts

APPENDIX A

Baseline Human Health Risk Assessment Outline

Draft Baseline Human Health Risk Assessment Report

1.0 Introduction/Hazard Identification
- 1.1 Site description and history
  - 1.1.1 Present and future land use
  - 1.1.2 Human receptors (including type, location and numbers)
- 1.2 Nature and extent of contamination found at the site
- 1.3 Selection of contaminants of concern
  - 1.3.1 Health based ARARs (e.g. MCL/MCLG/MEG)
- 1.4 Fate and transport

2.0 Exposure Assessment
- 2.1 Exposure pathways
- 2.2 Exposure scenarios
  - 2.2.1 Exposure point concentrations (ug/l, mg/kg, ug/m3)
  - 2.2.2 Exposure dose levels (mg/kg/day)

3.0 Dose Response Evaluation
- 3.1 Dose response criteria for carcinogenic effects
- 3.2 Dose response criteria for noncarcinogenic effects

4.0 Risk Characterization
- 4.1 Narrative and tables summarizing the carcinogenic and noncarcinogenic risks by exposure pathway for the present and potential future exposure scenarios

5.0 Uncertainty/Limitations

6.0 References

7.0 Appendices
- 7.1 Documentation/data
- 7.2 Toxicity profiles for contaminants of concern

APPENDIX B

Baseline Ecological Risk Assessment Outline

Draft Baseline Ecological Risk Assessment Report

1.0 Introduction

2.0 Objectives

3.0 Hazard Identification

3.1 Site Characterization

This section shall:

3.1.1 identify the nature, extent, and sources of contamination through the various exposure pathways of concern.

3.1.2 describe the topography, hydrology, and other physical, spatial, or other features of ecological interest at and adjoining the site.

3.1.3 discuss the habitat types and associated species found or expected at or adjacent to the site, or that would otherwise be expected to be affected by contamination from the site.

3.1.4 highlight any species that are federally endangered or threatened, of special concern to the State, that are Trustee resources, or other species of interest (i.e., of particular economic or social importance).

3.2 Selection of Contaminants of Concern, Indicator Species and Endpoints

This section shall:

3.2.1 list the contaminants that have been selected. Summarize the criteria for selection of contaminants of concern, and briefly discuss the relationship between each selected compound and the factors considered during selection. Factors to be addressed include, but are not limited to, persistence, bioaccumulation, biomagnifications, toxicity, frequency of detection, and concentrations detected and the relationship of these concentrations to a control or "background".

3.2.2 describe the indicator species and endpoints which have been selected. Discuss the criteria for selection, and how those species and endpoints related to the criteria. These criteria include but are not limited to the importance and position of the species within the ecosystem, sensitivity, seasonality, relevance to the specific ecosystem found at the site and to human beneficial uses, Trustee or regulatory concerns, and availability of practical methods for prediction and measurement.

4.0 Exposure Assessment

4.1 Source Characterization and Selection of Exposure Pathways

This section shall summarize the source areas of concern and discuss for each area (and, if necessary, by type of contaminants) by indicator species, what exposure pathways will be of concern and considered for further analysis.

4.2 Fate and Transport Analysis

This section shall include operable unit-specific data, applicable models, and information available through the literature.

4.3 Exposure Scenarios and Integrated Exposure Analysis

This section shall determine the exposure scenarios applicable given the selected exposure pathways, chemicals of concern, indicator species, and endpoints. Take into account spatial and temporal variations in exposure, mechanisms of migrations, points of exposure, behavioral adaptations, and population characteristics. If a food web or complex model is to be constructed, discuss the relationships established between the various species and trophic levels represented in the food web (for example, k of dietary uptake, BCFS, BMFS, duration of exposure).

4.4 Uncertainty Analysis

5.0 Toxicity Assessment

5.1 Hazard Identification

This section shall identify the potential toxic endpoints of the chemicals of concern upon the indicator species.

5.2 Quantitative Dose-Response Assessment This section shall:

5.3 evaluate both literature/laboratory data, as well as site-specific data where available.

5.4 present any applicable benchmark values available for comparison with site conditions. These benchmarks shall include ARARs (where available), sediment quality criteria, equilibrium partitioning values, or other published or peer reviewed values.

5.5 Uncertainty Analysis

6.0 Risk Characteristics

6.1 Selection of Risk Assessment Characterization Methodology

6.2 Presentation of Risk Assessment Characterization

This section shall:

6.2.1 Provide narrative and tabular summaries of the risk predictions by exposure pathway and by indicator species; and evaluate both single and multiple chemical effects where applicable. Note specific spatial or temporal distributions if risk is estimated.

6.2.2 Discuss and quantify (where possible) risks at the community and ecosystem level.

APPENDIX C

Remedial Investigation Report Outline

Draft Remedial Investigation Report

1.0 Introduction
- 1.1 Purpose of Report
- 1.2 Site Background
- 1.3 Site Description
- 1.4 Site History
- 1.5 Previous Investigations
- 1.6 Report Organization

2.0 Study Area Investigation
- 2.1 Includes field activities associated with site characterization. These may include physical and chemical monitoring of some, but not necessarily all, of the following:
  - 2.1.1 Surface Features (topographic mapping, etc.) (natural and man made features)
  - 2.1.2 Contaminant Source Investigations
  - 2.1.3 Meteorological Investigations
  - 2.1.4 Surface Water and Sediment Investigations
  - 2.1.5 Geological Investigations
  - 2.1.6 Soil and Vadose Zone Investigations
  - 2.1.7 Groundwater Investigations
  - 2.1.8 Human Population Surveys
  - 2.1.9 Ecological Investigations
- 2.2 If technical memoranda documenting field investigations were prepared, they may be included in an appendix and summarized in this report chapter.

3.0 Physical Characteristics of the Study Area
- 3.1 Includes results of field activities to determine physical characteristics. These may include some, but not necessarily all, of the following:
  - 3.1.1 Surface Features
  - 3.1.2 Meteorology
  - 3.1.3 Surface Water Hydrology
  - 3.1.4 Geology
  - 3.1.5 Soils
  - 3.1.6 Hydrogeology
  - 3.1.7 Demography and Land Use
  - 3.1.8 Ecology

4.0 Nature and Extent of Contamination
- 4.1 Presents the results of site characterization, both natural and chemical components and contaminants in some, but not necessarily all, of the following media:
  - 4.1.1 Sources (lagoons, sludges, tanks, etc.)
  - 4.1.2 Soils and Vadose Zone
  - 4.1.3 Groundwater
  - 4.1.4 Surface Water and Sediments
  - 4.1.5 Air

5.0 Contaminant Fate and Transport
- 5.1 Potential Routes of Migration (i.e., air, groundwater, etc.)
- 5.2 Contaminant Persistence
  - 5.2.1 Discuss factors affecting contaminant migration for the media of importance (e.g., sorption onto soils, solubility in water, movement of groundwater, etc.)
- 5.3 Contaminant Migration
  - 5.3.1 Discuss factors affecting contaminant migration for the media of importance (e.g., sorption onto soils, solubility in water, movement of groundwater, etc.)
  - 5.3.2 Discuss modeling methods and results, if applicable.

6.0 Baseline Risk Assessment
- 6.1 Human Health Evaluation (see below for more detail)
  - 6.1.1 Exposure Assessment
  - 6.1.2 Toxicity Assessment
  - 6.1.3 Risk Assessment
- 6.2 Ecological Evaluation (see below for more detail)

7.0 Summary and Conclusions
- 7.1 Summary
  - 7.1.1 Nature and Extent of Contamination
  - 7.1.2 Fate and Transport
  - 7.1.3 Risk Assessment
- 7.2 Conclusions
  - 7.2.1 Data Limitations and Recommendations for Future Work
  - 7.2.2 Recommended Remedial Action Objectives

Appendices
A. Technical Memorandum on Field Activities (if available)
B. Analytical Data and QA/QC Evaluation Results
C. Risk Assessment Methods

APPENDIX D

Feasibility Study Report Outline

Draft Feasibility Study Report

Executive Summary

1. Introduction
   - 1.1 Purpose and Report Organization
   - 1.2 Background Information (Summarized from RI Report)
   - 1.3 Site Description
   - 1.4 Site History
   - 1.5 Nature and Extent of Contamination
   - 1.6 Contaminant Fate and Transport
   - 1.7 Baseline Risk Assessment

2. Identification and Screening of Technologies
   - 2.1 Introduction
   - 2.2 Remedial Action Objectives –
     Presents the development of remedial action objectives for each medium of interest. For each medium, the following should be discussed:
     - Contaminants of interest
     - Allowable exposure based on risk assessment (or ARARs)
     - Development of remediation goals
   - 2.3 General Response Actions –
     For each medium of interest, describes the estimation of areas or volumes to which treatment, containment, or exposure technologies may be applied.
   - 2.4 Identification and Screening of Technology Types and Process Options – For each medium of interest, describes:
     - 2.4.1 Identification and screening of technologies
     - 2.4.2 Evaluation of technologies and selection of representative technologies

3. Development and Screening of Alternatives
   - 3.1 Development of Alternatives –
     Describes rationale for combination of technologies/media into alternatives.
     Note: this discussion may be by medium, operable unit, or the site as a whole.
   - 3.2 Screening of Alternatives (if conducted)
     - 3.2.1 Introduction
     - 3.2.2 Alternative 1
       - 3.2.2.1 Description
       - 3.2.2.2 Evaluation
     - 3.2.3 Alternative 2
       - 3.2.3.1 Description
       - 3.2.3.2 Evaluation
     - 3.2.4 Alternative 3

4. Detailed Analysis of Alternatives
   - 4.1 Introduction
   - 4.2 Individual Analysis of Alternatives
     - 4.2.1 Alternative 1
       - 4.2.1.1 Description
       - 4.2.1.2 Assessment